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DEVELOPMENT OF THE RADIATIVE TRANSFER PORTION OF A 1-D PHOTOCHEMICAL DIFFUSIVE STRATOSPHERIC MODEL

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This report summarizes the development and implementation of an advanced state-of-the-art computer code, the Chlorine Model Study Program (CMSP), which models the trace gas composition of the atmosphere from the surface to 80 km employing over sixty relevant chemical reactions and parameterizing vertical transport by a selected eddy diffusion profile.

A significant feature is the computation of solar flux available for photolysis by a multiple scattering atmosphere including the effect of surface reflection.

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20. ABSTRACT (cont)

Program documentation includes a complete listing of the code, a detailed flow chart, and several test case results in addition to a detailed program description and users guide.

TABLE OF CONTENTS

1. Introduction

This report summarizes the implementation and further development of the Chlorine Model Study Program (CMSP) performed by Environmental Research & Technology, Inc. (ERT) under the sponsorship of the Electronic Systems Division, U.S.A.F. Systems Command, Hanscom AFB, Massachusetts.

The CMSP is an advanced state-of-the-art computer code which models the trace gas composition of the atmosphere from the surface to 80 km employing over sixty chemical reactions in addition to allowing for vertical transport parameterized by a selected set of eddy diffusion coefficients. In its original formulation, the model only computed photolysis for the one-way passage of solar radiation through the atmosphere (absorption only). In the present version the effects of multiple scattering and surface reflection have been incorporated into the radiative transfer section of the program thus allowing for more realistic simulation of the effects of injected pollutants into the atmosphere.

The text which follows constitutes a basic program description, documentation, and users guide. Section 2 discusses the theoretical basis of the model including the governing continuity and flux equations for the steady-state version in addition to the chemical system adopted. Section 3 provides a description of the development of the radiative transfer section including the technique employed to perform the multiple scattering calculation and some representative results (Appendix C). Section 4 constitutes a comprehensive program description utilizing a complete program listing (Appendix A) and a flow chart (Appendix B) to aid in the exposition of the detailed calculation. Finally, Section 5 is included as a basic users guide containing instructions for program implementation and execution.

2. Theoretical Basis

2.1 Governing Model Equations

The CMSP program is a 1-dimensional (vertical dependence), steady state (no time dependence) mathematical model of the trace gas chemical composition of the atmosphere from the surface to 80 km. Specifically, the species dealt with include odd oxygen (O, O_3), odd hydrogen (H, OH, HO_2, H_2O_2), odd nitrogen (NO, NO_2, HNO_3), and odd chlorine (Cℓ, HCℓ, CℓO). Physical processes which determine the local abundances of these and other minor species include chemical kinetics, photochemistry, and turbulent transport. Radiative transfer is indirectly involved since it determines the number of photons available for photodissociation. (See Section 3).

The model is similar to those of Wofsy, McElroy and Sze (1975) and Sze and McElroy (1975) with several modifications. The governing continuity and diffusion equations are:

$$\frac{\partial \phi_i}{\partial Z} = P_i - L_i N f_i \qquad (2\text{-}1)$$

and

$$\frac{\partial f_i}{\partial Z} = -\phi_i / KN \qquad (2\text{-}2)$$

where ϕ_i is the vertical flux (cm^{-2} sec^{-1}), N the atmospheric total number density (cm^{-3}), K the eddy coefficients (cm^2 sec^{-1}) and P_i and L_i are respectively the local production (cm^{-3} sec^{-1}) and loss frequency (sec^{-1}), i denotes the i^{th} species, and f_i is the mixing ratio (v/v). Distinctions between long lived species (e.g. N_2O, CH_4, $CF_2Cℓ_2$) and short lived species (e.g. Cℓ, OH, NO) lead to enormous simplication in calculations.

For instance, the time constants for apportionment of CℓX among various forms of odd chlorine (Cℓ, CℓO, HCℓ, CℓOO, $Cℓ_2$) are rapid compared to the time constant for vertical motion. Densities of individual CℓX species

can be calculated with the equations of photochemical equilibrium, i.e.

$$P_i - L_i N f_i = 0 \text{ for each species} \qquad (2\text{-}3)$$

Likewise, photochemical equilibrium can be applied to the short lived hydrogen species (H, OH, HO_2, H_2O_2), to NO_x (NO, NO_2, HNO_3), to $O(^3P)$ and to $O(^1D)$. On the contrary, vertical flow is allowed for long-lived species such as CH_4, N_2O, CO, $CF_2C\ell_2$, $CFC\ell_3$, and O_3 (below 30 km) and the total family concentrations for HO_x, NO_x, and $C\ell x$. In this case, equations (2-1, 2-2) must be solved simultaneously.

Equations (2-1) and (2-2) are coupled differential equations with <u>two</u> point boundary conditions. They are usually solved by using the conventional finite difference method or the shooting method. However, more efficient schemes have recently been developed to improve computational efficiency. The numerical approach utilized is based on a Riccati scheme developed by Sze (1973) and subsequently applied to investigations relating to the Venus (Sze and McElroy, 1975) and Earth's atmosphere. In essence, the Riccati scheme transforms (2-1) and (2-2) into a non-coupled systen with a <u>one</u> point boundary condition. This technique greatly reduces the computational complexity of the problem and facilitates numerical solutions of differential equations of the type described here.

In the one-dimensional model, the crucial transport parameter is the vertical eddy diffusion coefficient K_{zz}. In the current model three options exist to vary the assumed K_{zz} profile to simulate measured data and perform sensitivity analyses. (See Section 4.3.2). The neutral atmosphere used in the calculation is summarized in Table 2-1 (a particular eddy diffusion profile is demonstrated). Photolysis processes for aeronomically significant molecules are summarized in Table 2-2. Computations of photodissociation rates (or J-values) are accomplished (See Section 3-1)

TABLE 2-1

ATMOSPHERIC MODEL

Altitude (km)	Eddy Diffusion Coefficient ($cm^2\ sec^{-1}$)	Number Density (cm^{-3})	Temperature (°K)
0	1.4000E 05	2.4110E 19	304.58
2	1.4000E 05	2.1050E 19	289.56
4	1.4000E 05	1.6510E 19	277.87
6	1.4000E 05	1.3400E 19	266.52
8	1.4000E 05	1.0880E 19	252.41
10	4.2000E 04	8.7330E 18	238.39
11	4.2000E 04	6.9130E 18	224.42
14	4.2000E 04	5.9310E 18	210.50
16	3.6400E 03	4.1030E 18	203.15
18	4.6200E 03	2.8240E 18	207.38
20	5.8800E 03	2.0000E 18	211.75
22	7.4200E 03	1.4290E 18	215.94
24	9.2400E 03	1.0320E 18	219.20
26	1.1620E 04	7.4450E 17	223.84
28	1.4140E 04	5.4230E 17	227.83
30	1.8200E 04	3.9700E 17	231.79
32	2.2400E 04	2.9240E 17	235.74
34	2.8700E 04	2.1590E 17	240.40
36	3.5700E 04	1.6040E 17	245.14
38	4.4800E 04	1.1980E 17	249.88
40	5.6000E 04	8.9990E 16	254.62
42	7.0000E 04	6.7980E 16	259.35
44	8.9600E 04	5.1610E 16	264.08
46	1.1200E 05	3.9390E 16	268.80
48	1.4000E 05	3.0350E 16	272.15
50	1.7920E 05	2.3720E 16	272.15
52	2.2400E 05	1.8600E 16	271.14
54	2.8000E 05	1.4710E 16	267.21
56	3.5000E 05	1.1590E 16	263.28
58	4.3400E 05	9.1050E 15	259.36
60	5.3200E 05	7.1440E 15	254.79
62	7.0000E 05	5.6360E 15	247.35
64	8.6800E 05	4.4160E 15	239.91
66	1.0500E 06	3.4350E 15	232.47
68	1.3440E 06	2.6620E 15	225.04
70	1.6800E 06	2.0260E 15	217.61
72	2.1000E 06	1.5350E 15	210.19
74	2.6600E 06	1.1520E 15	202.77
76	3.3600E 06	8.5540E 14	195.36
78	4.2000E 06	6.2810E 14	187.95
80	5.3200E 06	4.5560E 14	180.54

TABLE 2-2

PHOTOLYSIS PROCESSES (sec^{-1})

J_1	$O_2 + h\nu \rightarrow 2\ O$
J_2	$O_3 + h\nu \rightarrow O(^1D) + O_2$
J_3	$O_3 + h\nu \rightarrow O(^3P) + O_2$
J_4	$H_2O + h\nu \rightarrow H + OH$
J_5	$N_2O + h\nu \rightarrow N_2 + O$
J_6	$CH_4 + h\nu \rightarrow CH_3 + H$
J_7	$CH_3Cl + h\nu \rightarrow CH_3 + Cl$
J_8	$CFCl_3 + h\nu \rightarrow CFCl_2 + Cl$
J_9	$CF_2Cl_2 + h\nu \rightarrow CF_2Cl + Cl$
J_{10}	$CCl_4 + h\nu \rightarrow CCl_3 + Cl$
J_{11}	$HCl + h\nu \rightarrow H + Cl$
J_{12}	$NO_2 + h\nu \rightarrow NO + O$
J_{13}	$NO_3 + h\nu \rightarrow NO + O_2$
J_{14}	$NO_3 + h\nu \rightarrow NO_2 + O$
J_{15}	$N_2O_5 + h\nu \rightarrow NO_3 + NO_2$
J_{16}	$HNO_3 + h\nu \rightarrow OH + NO_2$
J_{17}	$NO + h\nu \rightarrow N + O$
J_{18}	$H_2O_2 + h\nu \rightarrow 2OH$
J_{19}	$HO_2 + h\nu \rightarrow H + O_2$
J_{20}	$ClO + h\nu \rightarrow Cl + O$
J_{21}	$HOCl + h\nu \rightarrow OH + Cl$
J_{22}	$ClONO_2 + h\nu \rightarrow ClO + NO_2$
J_{23}	$H_2CO + h\nu \rightarrow H_2 + CO$
J_{24}	$H_2CO + h\nu \rightarrow H + HCO$

using solar flux data obtained from the Handbook of Geophysics and Space Environments (1965). For the spectral region between 1750-3000Å flux measurements were adopted from Detwiler, et. al. (1961). Below 1750Å, the more recent data by Widing, et. al. (1970) are utilized. Computations are made using either a 24-hour averaged value of the solar flux or a single solar zenith angle (specified by ISWIT, Section 4.4). Table 2-3 contains the reactions and adopted rate constants for the relevant odd oxygen, hydrogen, nitrogen, and chlorine species. These rates are referenced to 80 km. Temperature dependence of the rate constants as a function of the temperature profile is given.

2.2 Summary of Relevant Stratospheric Chemistry

This section provides a brief review of the critical atmospheric species handled by the CMSP program.

The chemistry of atmospheric ozone was formulated by Chapman (1930). Chapman's model consists of four reactions involving only oxygen chemistry. He proposed that ozone is initiated by photolysis of O_2 in the Herzberg continuum below 2400 Å, as

$$O_2 + h\nu \rightarrow 2O \tag{2-4}$$

followed by the three body reaction

$$O + O_2 + M \rightarrow O_3 + M \tag{2-5}$$

Ozone may be recycled by

$$O_3 + h\nu \rightarrow O_2 + O \tag{2-6}$$

followed by (2-5). Odd oxygen (O, O_3) is removed by

$$O + O_3 \rightarrow 2O_2 \tag{2-7}$$

Using reactions (2-4) to (2-7), and assuming photochemical equilibrium conditions, ozone concentration may be expressed in a simple analytic form:

$$[O_3] = \left(\frac{J_1}{J_3}\right)^{1/2} \left(\frac{k_2}{k_4}\right)^{1/2} [O_2][M]^{1/2} \tag{2-8}$$

TABLE 2-3

REACTION RATE
(AS A FUNCTION OF ALTITUDE, Z) = A
* EXP (B/TEMP (Z))

No.	REACTION		A	B
1	OH + CH3CL	= CH2CL + H2O	1.66E-12	-1070.
2	H2O + O('D)	= 2OH	2.35E-10	0.
3	CH4 + O('D)	= CH3 + OH	1.40E-10	0.
4	H2 + O('D)	= OH + H	1.00E-10	0.
5	H + O2 + M	= HO2 + M	1.80E-32	340.
6	H + O3	= OH + O2	2.60E-11	0.
7	OH + O3	= HO2 + O2	2.30E-12	-1125.
8	OH + H2O2	= H2O + HO2	1.00E-11	-750.
9	HO2 + O3	= OH + 2O2	1.00E-13	-1525.
10	HO2 + O	= OH + O2	1.00E-10	-250.
11	HO2 + NO	= OH + NO2	1.10E-11	-1000.
12	HO2 + CLO	= HCLO + O2	0.0	0.
13	HO2 + HO2	= H2O2 + O2	5.00E-12	-500.
14	HO2 + OH	= H2O + O2	2.00E-11	0.
15	HO2 + CL	= HCL + O2	3.00E-11	0.
16	H + HO2	= H2 + O2	1.00E-11	0.
17	H + HO2	= 2OH	4.20E-10	-950.
18	OH + CO	= H + CO2	2.10E-13	-115.
19	OH + O	= H + O2	1.00E-10	-250.
20	OH + HCL	= H2O + CL	2.00E-12	-313.
21	OH + CH4	= H2O + CH3	2.36E-12	-1710.
23	OH + HNO3	= H2O + NO3	1.00E-12	-600.
24	OH + OH	= H2O + O	1.70E-12	0.
25	OH + H2	= H2O + H	6.70E-12	-2010.
26	CL + H2	= HCL + H	5.70E-11	-2400.
27	CL + H2O2	= HCL + HO2	6.00E-13	0.
28	CLO + NO2 + M	= CLNO3 + M	3.80E-33	1055.
29	CL + O3	= CLO + O2	2.70E-11	-257.
30	C1 + CH4	= HCL + CH3	7.29E-12	-1260.
31	CLO + O	= CL + O2	1.07E-10	-224.
32	CLO + NO	= CL + NO2	2.00E-11	0.
33	O + HCL	= OH + CL	0.0	0.
34	O + O2 + M	= O3 + M	1.05E-34	520.
35	O + O3	= 2O2	1.30E-11	-2140.
36	NO2 + NO3	= N2O5*	1.00E-12	0.
38	N2O5* + M	= N2O5 + M	3.70E-11	0.
39	N2O5 + M	= N2O5* + M	9.00E-06	-9700.
40	NO + O3	NO2 +o2	2.30#-12	-1450.
41	NO2 + o3	= NO3 + O2	1.20E-13	-2450.
42	NO2 + O	= NO + o2	9.12E-12	0.
43	N2O + O('D)	= N2 + O2	5.00E-11	0.
44	N2O + O('D)	= 2NO	7.00E-11	0.
45	N + NO	= N2 + O	2.00E-11	0.
46	N + O2	= NO + O	5.50E-12	-3200.
47	O('D) + CFCL3	= PRODUCTS	3.00#-10	0.
48	O('D) + CF2CL3	= PRODUCTS	3.00E-10	0.
49	O('D) + CH3CL	= OH + CH2CL	0.0	0.
50	O('D) + CCL4	= PRODUCTS	0.0	0.
51	O('D) + M	= O + M	2.00E-11	107.

Reactions Whose Rates Are Calculated By Different Formulae Are:

22	OH + NO2 + M	= HNO3 + M	R = 2.3E-13*EXP(880./Temp.(Z)/(2.6E18 + M(Z))
37	N2O5*	= NO2 + NO3	R + 1.0E+8*M(Z)/(2.6E19+M(Z)) + 1.0E7

where J_1 and J_3 are the photolysis rates for reaction (2-4) and (2-5) and k_2 and k_4 are the rate constants for reactions (2-5) and (2-7), respectively.

Equation (2-8) gives a good first order model of the vertical distribution of atmospheric ozone. It successfully predicts the ozone peak at around 25 km. However, it predicts too much ozone at all altitudes above 22 km, and it overestimates the total ozone abundance by about a factor of 2. Furthermore, Chapman's simple model does not include atmospheric transport processes and cannot account for the observed latitudinal distribution of ozone - low values at low latitudes and high values at high latitudes.

Bates and Nicolet (1950) first attempted to remove the discrepancies between observations and Chapman's theory by introducing catalytic hydrogen chemistry. (the HO_x family). Catalysis of odd oxygen recombination by hydrogen species (H, OH, HO_2) may take place either through

$$H + O_3 \rightarrow OH + O_2 \qquad (2\text{-}9)$$

followed by

$$OH + O \rightarrow O_2 + H; \qquad (2\text{-}10)$$

or through

$$H + O_2 + M \rightarrow HO_2 + M \qquad (2\text{-}11)$$

followed by

$$HO_2 + O \rightarrow OH + O_2 \qquad (2\text{-}12)$$

These reactions are important above 50 km, and account for a reduction by about a factor of 2 to 3 in the concentration of ozone calculated by Equation (2-8).

Atmospheric odd hydrogen (H, OH, HO_2, H_2O_2) is mainly formed by reactions involving H_2O molecules;

$$H_2O + O(^1D) \rightarrow 2\ OH \qquad (2\text{-}13)$$

and

$$H_2O + h\nu \rightarrow OH + H \qquad (2\text{-}14)$$

They are mainly removed by reactions

$$OH + HO_2 \rightarrow H_2O + O_2 \qquad (2\text{-}15)$$

and

$$OH + H_2O_2 \rightarrow HO_2 + H_2O \qquad (2\text{-}16)$$

For a given H_2O concentration, the abundance of odd hydrogen is mainly controlled by reactions (2-13) to (2-16). Reaction (2-15) is the dominant loss process for odd hydrogen above 35 km.

The principal stratospheric sink for O_3 was not identified until 1970 when Crutzen (1970) and Johnston (1971) suggested that nitric oxide (NO) can catalytically recombine O and O_3 through the reaction

$$NO + O_3 \rightarrow NO_2 + O_2 \qquad (2\text{-}17)$$

followed by

$$NO_2 + O \rightarrow NO + O_2 \qquad (2\text{-}18)$$

Oxides of nitrogen, NO_x (NO, NO_2, NO_3, N_2O_5, HNO_3) are formed in the stratosphere by photochemical decomposition of N_2O (McElroy and McConnell, 1971):

$$N_2O + O(^1D) \rightarrow 2NO \qquad (2\text{-}19)$$

Nitrous oxide (N_2O) is mainly produced in soil as a by-product of the denitrification process, with some contribution from high temperature combustion processes.

The possible importance of chlorine chemistry in the stratosphere was noted by Wofsy and McElroy (1974) and by Stolarski and Cicerone (1974). They suggested that free chlorine may play a role similar to NO_x in the recombination of O and O_3 through the reactions

$$Cl + O_3 \rightarrow ClO + O_2 \qquad (2\text{-}20)$$

followed by

$$C\ell O + O \rightarrow C\ell + O_2 \qquad (2\text{-}21)$$

A source of stratospheric $C\ell$ was not identified until Molina and Rowland (1974) suggested the photolysis of flourocarbons (F-11, F-12) through the reactions

$$CFC\ell_3 + h\nu \rightarrow CFC\ell_2 + C\ell \qquad (2\text{-}22)$$

and

$$CF_2C\ell_2 + h\nu \rightarrow CF_2C\ell + C\ell \qquad (2\text{-}23)$$

These reactions constitute the basis of the $C\ell X$ family of the CMSP program.

Theoretical model calculations [Wofsy et. al. (1975), Crutzen (1974)] have shown that continued release of flourocarbons (CFMs) at 1973 production rates might lead to approximately 7 to 12 percent ozone reduction in the year 2200. These results have led to the current concern regarding the effects of CFMs on stratospheric ozone.

Prior to 1976, it was thought that $HC\ell$ was the only inert form of odd chlorine species. The chemistry of chlorine nitrate, $C\ell ONO_2$, was ignored until Rowland et. al. (1976) measured the absorption cross section of $C\ell ONO_2$, which suggested its appreciable life time ($\sim$ 1 day) in the mid-stratosphere. Chlorine nitrate is formed by a three body reaction

$$C\ell O + NO_2 + M \rightarrow C\ell ONO_2 + M \qquad (2\text{-}24)$$

with a rate constant

$$k_{24} = 5.1 \times 10^{-33} \exp(-900/T)$$

Formation of $C\ell ONO_2$ would tie up the active $C\ell$ and NO_x -species, and could lower the catalytic efficiency of <u>both</u> the $C\ell X$ and NO_x cycles.

3. Development of the Radiative Transfer Section

3.1 Discussion

In the basic version of the CMSP program only the most elementary radiative transfer process, that of absorption by molecular oxygen and ozone, is incorporated within the calculation of photodissociation rates. However, surface reflection and atmospheric multiple scattering of incident solar radiation by molecules and aerosols can significantly enhance the photolysis rates of certain stratospheric species (Luther and Gelinas, 1976) and may have an appreciable effect on stratospheric photochemistry (Sze and Tripp, 1977).

The photodissociation rate (sec^{-1}) of species i at altitude z is given by:

$$J_i(t,z) = \int_\lambda \pi F_\lambda (t,z)\, \sigma_{\lambda,i}\, \Phi_{\lambda,i}\, d\lambda \qquad (3\text{-}1)$$

where

$\sigma_{\lambda,i}$ = absorption cross section of species i at wavelength λ (cm^2)

$\Phi_{\lambda,i}$ = quantum yield of species i at wavelength λ (dimensionless)

$\pi F_\lambda(t,z)$ = flux at level z available for photodissociations at a time t (photons cm^{-2} sec^{-1} $\overset{o}{A}^{-1}$).

In the pure absorption model, the available photons are calculated based on attenuation of the direct solar beam by O_2 and O_3 or:

$$\pi F_\lambda (t,z) = \pi F_o \exp\left[-\tau(z)/\mu_o\right] \qquad (3\text{-}2)$$

where

πF_o = unattenuated solar flux

μ_o = cosine of the solar zenith angle

$$\tau(z) = \int_z^\infty \sum_i \sigma_{i,a}\, n_i\, (z)\, dz \qquad (3\text{-}3)$$

$\sigma_{i,a}$: absorption cross section of species i. (cm^2)

n_i: local number of density of species i. (cm^{-3})

The flux depends on time through variation of the solar zenith angle with time of day:

$$\mu_o = \cos\theta \cos\delta \cos\left(\frac{t}{240}\right) + \sin\theta \sin\delta \qquad (3\text{-}4)$$

where

θ = latitude (deg.)

δ = solar declination angle (deg.)

t = local time (sec)

The single solar zenith angle photolysis rate is given by (3-1).

The 24 hour averaged photolysis rate is given by:

$$\overline{J}_i(z) = \frac{1}{86400} \int_0^{86400} J_i(t,z)\, dt \qquad (3\text{-}5)$$

In order to account for the effects of multiple scattering, the radiative transfer equation:

$$\mu \frac{dI(\tau,\mu)}{d\tau} = I(\tau,\mu) - S(\tau,\mu) \qquad (3\text{-}6)$$

must be solved at each level of the atmosphere for each frequency.

The flux available for photodissociation πF is then given by:

$$F(\tau) = 2 \int_{-1}^{+1} I(\tau,\mu)\, d\mu \qquad (3\text{-}7)$$

In Eqn (3-6), $S(\tau,\mu)$ is the source function which obeys the integral equation:

$$S(\tau) = \frac{\omega_0(\tau)}{4} F_0 \cdot \exp(-\tau/\mu_0) + \frac{\omega_0(\tau)}{2} \int_0^{\tau^*} S(t) E_1(|t-\tau|)\, dt$$

$$\cdot + 2 \cdot \frac{\omega_0(\tau)}{2} \cdot R \cdot E_2(\tau^*-\tau) \int_0^{\tau^*} S(t)\, E_2(\tau^*-t)\, dt \qquad (3\text{-}8)$$

$$+ \frac{\omega_0(\tau)}{2} \cdot \mu_0 \cdot F_0 \cdot R \cdot E_2(\tau^*-\tau) \cdot \exp(-\tau^*/\mu_0)$$

where

$$E_n(x) = \int_0^1 \exp(-x/\mu)\, \mu^{(n-1)}\, \frac{d\mu}{\mu}$$

R = ground reflectivity

$$\tau^* = \text{(total) optical depth} = \int_0^\infty \sum_i \sigma_i\, n_i(z)\, dz$$

and ω_0 = single scattering albedo

$$\omega_0(z) = \frac{\sum_i \sigma_{s,i}\, n_i(z)}{\sum_i \sigma_{s,i}\, n_i(z) + \sum_i \sigma_{a,i} n_i(z)}$$

In Eqn (3-8) the optical depth τ is computed using the extinction cross section ($\sigma_i = \sigma_{s,i} + \sigma_{a,i}$) where $\sigma_{s,i}$ is the scattering cross section of species i as compared with the absorption cross section only in Eqn (3-3)

Sources of scattering opacity include both atmospheric gases (Rayleigh scattering) and polydisperse aerosol distributions (Mie scattering). Evaluation of the Rayleigh scattering cross section at each level is accomplished using (McClatchey, et. al., 1972)

$$\sigma_{s,\text{Rayleigh}}(z) = \left(9.807 \times 10^{-25} \nu^{4.0117}\right) \frac{N(z)}{N(z=0)} \qquad (3.9)$$

where: ν = frequency in wave numbers (cm^{-1})

$N(z)$ = total number density at level z (cm^{-3})

Aerosol models have been adopted from Shettle and Fenn (1976) which provides the wavelength dependence of the absorption and extinction cross sections for four characteristic aerosol models: maritime, urban, rural, and tropospheric. The first three are, strictly speaking, boundary layer models while the tropospheric model is more characteristic of the atmosphere above the boundary

layer. The altitude variation of the aerosol number densities (Table 3-1) is assumed to be the same for all models and is taken from Elterman (1968).

The surface is assumed to be Lambertian. The reflectivity (R) is defined as the ratio between the incoming and outgoing fluxes at the surface and the reflection is isotropic (i.e. no angle preference for the outgoing radiance). The reflected intensity at surface $I(\tau^*,\mu)$ can be written as

$$I(\tau^*,\mu) = 2 \cdot R \int_0^{\tau^*} S(t)\, E_2(\tau^*-t)\,dt \qquad (3\text{-}10)$$

3.2 Implementation of the Variational-Iterative (VI) Technique

Once equation (3-8) is solved for the source function, the total flux available for photodissociation $\pi F(\tau)$ in the fully scatering case is given by:

$$F(\tau) = F_o \exp(-\tau/\mu_o) + 2\int_0^{\tau^*} S(t)E_1(|t-\tau|)\,dt$$

$$+ 2\,\mu_o F_o R\, E_2(\tau^*-t)\exp(-\tau^*/\mu_o)$$

$$+ 4\,R \cdot E_2(\tau^*-t)\int_0^{\tau^*} S(t)\,E_2(\tau^*-t)\,dt \qquad (3\text{-}11)$$

The physical meaning of each term in Equation (3-11) is as follows:

1) the first term represents the attenuated direct beam. (This is the only term used in a pure absorption model).
2) the second term represents the diffuse radiation in the atmosphere due to scattering of the direct beam;
3) the third term represents the attenuated direct beam reflected from the surface with reflectivity R;
4) the fourth term represents the diffuse radiation due to scattering of the reflected beam.

This may be substituted into (3-1) to evaluate the photodissociation rates.

TABLE 3-1

ALTITUDE VARIATION OF AEROSOL NUMBER DENSITIES

Altitude (km)	Aerosol Number Density (cm^{-3})	Altitude (km)	Aerosol Number Density (cm^{-3})
0	2.8280E+03	42	7.9600E-02
2	5.3710E+02	44	5.7040E-02
4	1.1920E+02	46	2.8290E-02
6	6.3370E+01	48	2.0990E-02
8	6.7690E+01	50	1.0780E-02
10	5.6750E+01	52	5.5800E-03
12	5.5850E+01	54	4.1140E-03
14	5.1480E+01	56	2.0780E-03
16	4.5110E+01	58	1,4950E-03
18	4.3140E+01	60	7.7350E-04
20	2.6670E+01	62	4.0030E-04
22	1.4555E+01	64	2.8800E-04
24	8.1260E+00	66	1.4900E-04
26	5.7060E+00	68	1.0720E-04
28	3.5740E+00	70	5.5500E-05
30	2.2380E+00	72	2.1440E-05
32	1.1480E+00	74	1.3320E-05
34	8.2230E-01	76	5.1440E-06
36	4.2190E-01	78	3.1960E-06
38	3.0220E-01	80	1.2340E-06
40	1.5500E-01		

To solve the integral equation, (3-8), the variational-interative technique introduced by Sze (1976) was used. This method, in essence, provides a direct way for constructing an approximate source function for equation (3-8) and allows for arbitrary inhomogeneity in the atmosphere. It has been shown by Burke and Sze (1977) that the variational-iterative approach requires relatively little computational time to achieve satisfactory accuracy in comparison to other standard methods.

In the variational-iterative technique, the approximated source function can be expressed as:

$$S_a(\tau) = U_a(\tau) \sqrt{\omega_o(\tau)} , \tag{3-12}$$

where

$$U_a(\tau) = \Sigma_i C_i V_i(\tau) , \tag{3-13}$$

and $V_i(\tau)$ is trial function for the ith layer.

The total optical depth τ^* is divided into (N-1) layers with an average single scattering albedo ω_j assigned to each layer j. The simplest piece-wise continuous trial functions are the step functions defined by

$$V_j(\tau) = \begin{cases} 1 & \tau_j \leq \tau \leq \tau_j + 1 \\ 0 & \tau < \tau_j ; \tau > \tau_j + 1 \end{cases} . \tag{3-14}$$

It can be shown (Sze, 1976) that the C_i are solutions to the following set of linear algebraic equations:

$$\sum_{j=1}^{N} M_{ij} C_j = f_i . \tag{3-15}$$

The M_{ij} are simply given by

$$M_{ij} = \delta_{ij} \Delta\tau_j - \frac{\sqrt{\omega_i \omega_j}}{2} \int_{\tau_i}^{\tau_{i+1}} B_j(\tau)\, d\tau , \qquad (3\text{-}16)$$

where

$$\delta_{ij} = \begin{cases} 1 & \text{for } i=j \\ 0 & \text{for } i \neq j, \end{cases}$$

$$B_j(\tau) = \int_{\tau_j}^{\tau_{j+1}} E_i(|\tau - t|)\, dt ,$$

and f_i is

$$f_i = \frac{F_o}{4} \mu_o \sqrt{\omega_i} \left[\exp(-\tau_i/\mu_o) - \exp(-\tau_{i+1}/\mu_o)\right]$$

The smoothed approximated source function including the ground reflection can be written as

$$S_1(\tau) = \frac{\omega_o(\tau)}{4} F_o \exp(-\tau/\mu_o) + \frac{\omega_o(\tau)}{2} \sum_{j=1}^{N-1} C_j \sqrt{\omega_j} B_j(\tau)$$
$$+ \frac{\omega_o(\tau)}{2} \cdot R \cdot E_2(\tau^* - \tau) \left[2 \sum_{j=1}^{N-1} C_j \sqrt{\omega_j} D_j + \mu_o \exp(-\tau^*/\mu_o)\right] \qquad (3\text{-}17)$$

where

$$D_j = \int_{\tau_j}^{\tau_{j+1}} E_2(\tau^* - t)\, dt$$

Subsequent iterations

$$S_{n+1}(\tau) = \frac{\omega_o(\tau)}{4} F_o \exp(-\tau/\mu_o) + \frac{\omega_o(\tau)}{2} \int_o^{\tau_*} E_1(|\tau-t|)\, S_n(t)\, dt$$

$$+ \frac{\omega_o(\tau)}{2} \cdot R \cdot E_2(\tau^*-\tau)\left[2\int_o^{\tau_*} E_2(\tau^*-t)\, S_n(t)\, dt + \mu_o \exp(-\tau^*/\mu_o)\right] \quad (3\text{-}18)$$

would bring the source function to the desired accuracy.

3.3 Results

The results of two relevant calculations using the models described in the previous sections are contained in Appendix C. (A complete description of the output format is given in Section 4.5.) The first set of profiles is for an absorption only model where net fluxes are calculated using Eqn. (3-2). The second set is for a complete multiple scattering calculation [using equation (3-11)] where a surface reflectivity of 0.2 is assumed. Both calculations use a single solar zenith angle given by $\cos^{-1}(.707)$.

Several comparisons can be made between the calculations. In particular, the effect of multiple scattering and surface reflection on the photodissociation rate of O_3 be seen. Figure 3-1 illustrates the percent increase in the value of CJ03 for the two cases cited. A second curve (for a surface reflectivity of 0.8) indicates that highly reflecting surfaces and/or large expanses of cloud deck may have a significant impact on stratospheric photochemistry.

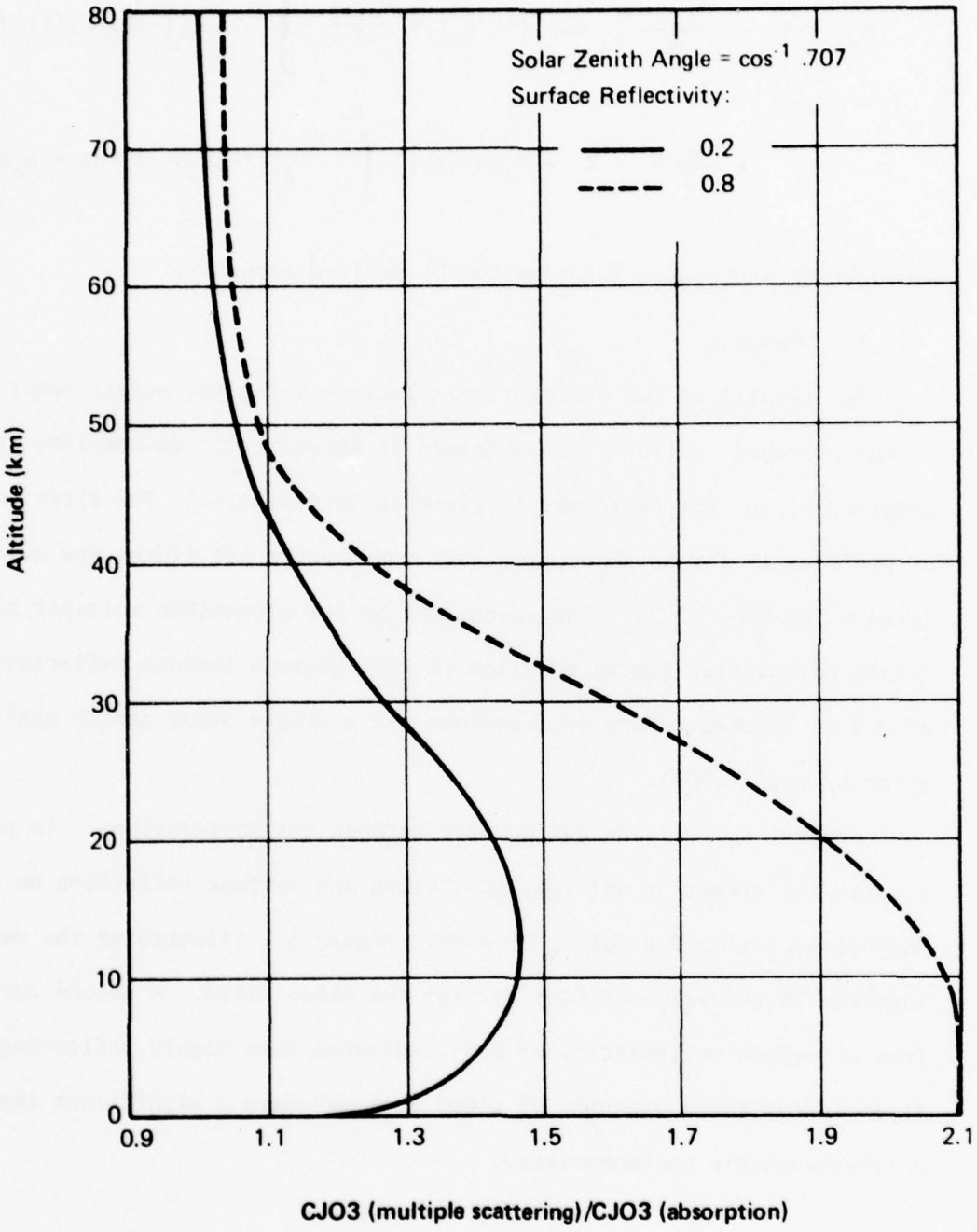

Figure 3-1 Percent Increase in Value of CJO3

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4. Program Description

4.1 Summary

The Chlorine Model Study Program (CMSP) computer code consists of a main program (MAIN), forty subroutines, function subprograms, and a subprogram Block Data of initialization and model parameters. The primary function of the main program is to select one of two operational modes determined by "keywords" read from the input set (see Section 5). Specification of the keyword PARAMETER calls subroutine INPARM which establishes the initial constants for each case. The keyword "RUN" directs the main program to call subroutine PHOCHM which conducts the actual photochemical calculation for each case. A keyword of "ENDJOB" causes the program to terminate.

Since the sequence of program logic is somewhat complex due to the nature of the problem, this section provides a narrative description including considerable detail within many of the relevant subroutines. For clarity, housekeeping subroutines found in the program listing (Appendix A) are neither included in the flow chart (Appendix B) nor discussed further in this section. (These subroutines such as INPUT, PAGE, LINE, DAY, ERRM, etc. perform such functions as page turning and reading, line count, date writing, and error flagging.) The reader is urged to utilize the program listing and flow chart in following through this program description.

Table 4-1 provides a schematic view of the CMSP logic which may be helpful. Here the most important subroutines are listed according to their calling order and priority within the program. Priority is designated by levels: Level 0 is assigned to the MAIN program, while numerically higher levels are more distant from the MAIN program. A level 3 subroutine, for example, will return to a level 2 subroutine and may call a level 4 subroutine. The overall function of each block of coding is designated

TABLE 4-1

SCHEMATIC PRESENTATION OF THE CHLORINE

MODEL STUDY PROGRAM COMPUTER CODE

Level 0	Level 1	Level 2	Level 3	Level 4	Function
MAIN					
	ALTGEN				
	INPARM				
		WEIGHT			
		QSCATT			Initialize
		CPHI1			
		SETUP			
			EDC1/EDC2		
		RCONST			
	PHOCHM				
		SETUP2			
		RJITER			
			COLDEN		
			COMPJ		Compute J Values
				COMTAU	
				OMEGA	
				VIM	
		INITAL			
			PCLOX		
			PNOX		
				QUAD	"Short-Lived" Species
		SOLVE			
			JACOB		
				QUAD	
			LINEQN		
			PNOX		
		CFLOW			
			RINTER		
			CSPEC		
				CXL	
				COEF	
				TRIDIA	"Long-Lived Species
			REPCN		
				PNOX	
				PCLOX	
			RINTER		
			SETUP 2		

at the right of the table. For example, PHOCHM (Level 1) calls RJITER (Level 2) and its higher level subroutines which compute photodissociation rates (so-called "J" values).

4.2 Initialization: BLOCK DATA

Although not contained explicitly within the flow chart, the BLOCK DATA section constitutes a significant source of input data and contains many of the run parameters which are required for model calculations. These data are introduced by DATA statements which are made accessible to the user subroutines by means of labeled COMMON statements. Table 4-2 lists the important model variables contained within BLOCK DATA including species mixing ratio or number density profiles, rate constant data, photodissociation cross section and rate values, and model atmosphere. Additionally, the corresponding labeled COMMON name is given. Values are compiled into their respective array locations based on their dependence on altitude or wavelength. Quantities characterizing the atmospheric model such as temperature (TEMP) and mixing ratios (H,OH, etc.) are given as level values at 2 km intervals from the surface to 80 km. Wavelength dependent quantities such as the solar flux (FL) and photodissociation cross sections (QO2, QO3 etc.) are digitized at wavelengths given by the array WL such that WL(1) is the wavelength at which the cross section of O_2 is QO2(1), etc.

In addition to vertical profiles and wavelength dependent spectra, BLOCK DATA also contains a large number of default values for branching parameters and other initial conditions specifiable for a particular case such as the boundary conditions on the fluxes or mixing ratios of certain species. These BLOCK DATA default values may be changed by utilizing the NAMELIST $INPUT (see Section 4.3.2) if desired, otherwise the default values are used. A complete description of these data is given in Section 5.2.

TABLE 4-2

BLOCK DATA SUPPLIED VALUES AND LABELED COMMON NAMES

Labeled Common Name	Variable Name	Identity	Units
MODEL	TEMP	temperature	^{o}K
	DM	total number density	cm^{-3}
	DID	$O(^1D)$ number density	cm^{-3}
	DA23	aerosol number density	cm^{-3}
RATES	RA	first rate constant	$cm^{3n}sec^{-1}$
	RB	second rate constant	^{o}K
RLOW	RN20	mixing ratio of N_2O at bottom	v/v
	RNOX	flux of NO_x at bottom	$cm^{-2}sec^{-1}$
	RCH4	mixing ratio of CH_4 at bottom	v/v
	RF11	flux of flourocarbon 11	$cm^{-2}sec^{-1}$
	RF12	flux of flourocarbon 12	$cm^{-2}sec^{-1}$
	RCH3C	mixing ratio of CH_3Cl at bottom	v/v
	RCLX	mixing ratio of Cl_x at bottom	v/v
	RCCL4	flux of CCl_4 at bottom	$cm^{-2}sec^{-1}$
	RO3	mixing ratio of O_3 at bottom	v/v
SOLCON	WL	wavelength	$\overset{o}{A}$
	FL	solar flux	$cm^{-2}sec^{-1}$
	QO2	photodissociation cross section O_2	cm^2
	QO3	photodissociation cross section O_3	cm^2
SOLCN1	QCF2	photodissociation cross section CF_2Cl_2	cm^2
	QCF3	photodissociation cross section $CFCl_3$	cm^2
	QCCL4	photodissociation cross section CCl_4	cm^2
	QCH3C	photodissociation cross section CH_3Cl	cm^2
	QCLNO3	photodissociation cross section $ClONO_2$	cm^2
	QN2O	photodissociation cross section N_2O	cm^2
	QHNO3	photodissociation cross section HNO_3	cm^2
	QH2O2	photodissociation cross section H_2O_2	cm^2
	QN2O5	photodissociation cross section N_2O_5	cm^2
	QHCL	photodissociation cross section HCl	cm^2
	QHOCL	photodissociation cross section HOCl	cm^2
	QNO2	photodissociation cross section NO_2	cm^2
	QH2O	photodissociation cross section H_2O	cm^2

TABLE 4-2 (Continued)

BLOCK DATA SUPPLIED VALUES AND LABELED COMMON NAMES

Labeled Common Name	Variable Name	Identity	Units
SPECIE	H	H number density	cm^{-3}
	OH	OH number density	cm^{-3}
	HO2	HO_2 number density	cm^{-3}
	H202	H_2O_2 number density	cm^{-3}
	03	O_3 number density	cm^{-3}
	0	0 number density	cm^{-3}
	NO	NO number density	cm^{-3}
	NO2	NO_2 number density	cm^{-3}
	HNO3	HNO_3 number density	cm^{-3}
	NOX	NO_x mixing ratio	v/v
	CO	CO mixing ratio	v/v
	CH4	CH_4 mixing ratio	v/v
	H2O	H_2O mixing ratio	v/v
	H2	H_2 mixing ratio	v/v
	CLX	Clx mixing ratio	v/v
PHRATE	JHCL	photodissociation rate HCl	sec^{-1}
	JCH4	photodissociation rate CH_4	sec^{-1}
	JN2O	photodissociation rate N_2O	sec^{-1}
	JN2O5	photodissociation rate N_2O_5	sec^{-1}
	JHNO3	photodissociation rate HNO_2	sec^{-1}
	JH2O2	photodissociation rate H_2O_2	sec^{-1}
	JNO2	photodissociation rate NO_2	sec^{-1}
	JCF2	photodissociation rate CF_2Cl_2	sec^{-1}
	JCF3	photodissociation rate $CFCl_3$	sec^{-1}
	JH2O	photodissociation rate H_2O	sec^{-1}
	JO3	photodissociation rate O_3	sec^{-1}
	JO2	photodissociation rate O_2	sec^{-1}
	JHOCL	photodissociation rate HOCl	sec^{-1}

4.3 Initialization Subroutines: ALTGEN, INPARM

4.3.1 Subroutine ALTGEN

Upon entering the MAIN program, subroutine ALTGEN is called. The primary function of this code is to fill the array ALT which is contained in labeled COMMON, MODEL and gives the altitude of each level in 2 km (2.0×10^5 cm) increments from 0.0 to 80.0 km. However, ALTGEN also provides revised solar flux data (overiding the values specified in BLOCK DATA) in the 1900 to 2250Å wavelength region and photodissociation cross sections for chlorine nitrate. Additionally, the aerosol model number density distribution with height is specified by the parameter IAERO[= 0 (23 km) or = 1 (5 km)] and the integrated total number density of molecules DMINT, and aerosols DAINT are computed above a given level. These integrated densities are later used in the evaluation of optical depth. After ALTGEN is called control is returned to MAIN.

4.3.2 Subroutine INPARM

The keyword PARAMETERS read from the input set directs the program to call subroutine INPARM. INPARM establishes the basic input parameters required to run the model calculation. This is accomplished both by direct modification of previously stored values in BLOCK DATA and by calling higher level subroutines to perform additional computations on the basic input set. A NAMELIST statement is provided which may be used (see Section 5) to change the values of any of the formatted parameters from the default values.

For example, ISWIT which determines whether a single sun angle (=0) or a 24 hour average (=1) is used in the J-value computation may be changed from the default value (1) to zero by using the NAMELIST $INPUT. The subroutine listing (Appendix A) illustrates which parameters may be changed.

Certain basic calculations are performed by calling subroutines WEIGHT, QSCATT, CPHI1, SETUP, and RCONST.

Subroutine WEIGHT computes the length of the day using the parameters LAT and DEL. The day is then divided into twelve equal time intervals (one hour at equinox) and the cosine of the solar zenith angle is computed at the midpoint of these intervals. Six values (those on either side of noon are equal) of the reciprocal of the cosine of the solar zenith angle are stored in array A. These are used to compute the 24 hour average model in subroutine COMTAU (Section 4.4.1).

Subroutine QSCATT computes the Rayleigh scattering coefficient QRAY, aerosol extinction coefficient QAE, and aerosol absorption coefficient QAA at the surface (z=0) as a function of wavelength. A particular aerosol size distribution is specified by the parameter ISIZE which selects one of four given models or a user's own model. (See Section 5.3). These values are later used in subroutine OMEGA to compute optical depth and the single scattering albedo profile when multiple scattering is considered.

Subroutine CPHI1 allows a quantum yield PHI1 to be introduced into the evaluation of the photodissociation rate for $ClONO_2$. Furthermore, it may be given one value P11 for wavelengths WL(1) to WL(I1), inclusive, and a second value P22 from WL(I1+1) to the upper wavelength limit. Default values in BLOCK DATA are I1 = 59, P11 = P22 = 1.0, so that the quantum yield is unity.

Subroutine SETUP establishes the eddy coefficient model to be used and operates on the basic 41 level model atmosphere data. Upon entering the subroutine, Hunten's eddy coefficients are read into array EK by a DATA statement. If NEDDY is zero, these values are used.

I NEDDY is either one or two, subroutine EDC1 or EDC2, respectively, is called which substitutes either Chang's or an analytic form for these values. NEDDY has a default value of zero and may be changed in the NAMELIST $INPUT. A factor FKK (default value - 1.0) may be specified to multiply any of these profiles by a constant value. The basic model atmosphere data (TEMP, DM, and EK) are then interpolated to produce arrays (CTEMP, CDM, and CEK) of 81 levels of 1 km thickness from the data arrays containing 41 levels of 2 km thickness. These results are printed out at 2 km intervals.

Subroutine RCONST calculates the reaction rates of each of the chemical reactions as a function of temperature at the 81 levels of the atmosphere. The required input consists of the model atmosphere temperature profile and the first and second Arrhenius rate constants RA and RB from BLOCK DATA or NAMELIST $INPUT For each reaction I and atmospheric level J the reaction rate RATE is given by:

RATE(I,J) = RA(I) * EXP(RB(I)/CTEMP(J))

Rates are computed explicitly for reactions which do not obey the above relation. A table of reactions and rate constant information is printed. (see listing, Appendix A). After execution of RCONST control reverts to INPARM which returns to MAIN.

4.4 Main Calculation: PHOCHM

As indicated in the flow chart the keyword RUN calls the subroutine PHOCHM. PHOCHM controls the remainder of the calculation for a particular case and may be considered as the main program for most purposes.

As PHOCHM is entered the steady state version is selected by specifying FT = 0., FA = 2., FB = 0. and FM = 0. (these values will be used by subroutine COEF in performing the long-lived species calculations. (see 4.4.3).

The functions performed within PHOCHM may be divided into three areas: (a) computation of photodissociation rates; (b) calculations for short-lived species (no diffusion); and (c) calculations for long-lived species (vertical diffusion). Most evaluations are made external to PHOCHM by calling appropriate higher level subroutines.

4.4.1 Subroutine RJITER: Computation of Photodissociation Rates

Subroutine RJITER functions as a calling program to facilitate the calculation of photodissociation rates at each atmospheric level. Its two arguments ISWIT and ISCATT are carried in COMMON to PHOCHM and specify the nature of the time averaging (single solar zenith angle vs. 24 hour average) and whether multiple scattering is considered, respectively. The upper limit for the wavelength integration IU is set in RJITER. For the absorption only model, the integration stops at 4025Å and the contributions to the dissociation of O_3 from the visible are included as a constant factor PJO3. (set in BLOCK DATA). When multiple scattering is considered, however, the integration is extended through the visible region.

RJITER calls subroutine COLDEN which computes the column densities of ozone from a given level to the top of the atmosphere. These values, DO3INT, are used in the computation of optical depth.

Subroutine COMPJ called from RJITER performs the actual wavelength integration. The specific details of the calculation depend on the parameters ISWIT and ISCATT. For the simplest case ISWIT = 0, ISCATT = 0, a fixed solar zenith angle GMU = .707 is used and the number of photons $cm^{-2}sec^{-1}$ available for photodissociation at a particular level is based on simple attenuation of the direct solar beam by O_2 and O_3 above the level. That is, optical depth TAU is computed as:

TAU = QO3 * DO3INT + QO2 * DMINT * PO2) and DMINT is the integrated total number density.

J values are then computed in a straightforward manner by taking the product of available flux (= FL * EXP (-TAU/GMU)), cross section (QO2, QO3, QHCl, etc.), and quantum yield if required (PHI1) at a given wavelength and integrating over the wavelength interval. Flux is reduced by a factor of 0.5 (RDF) for the single angle calculation to account for night and day.

When ISWIT = 1 and a 24 hour average model is required, the transmissivity from the top of the atmosphere to a given level is weighted by calling a subroutine COMTAU which uses the array of coefficients A computed by WEIGHT to simulate the variation of solar zenith angle over a day. The subroutine COMTAU essentially performs the calculation:

$$\text{TRAN (24 hr average)} = \frac{1}{24} \sum_{I=1}^{12} \text{EXP (-TAU * A (I))}$$

When a multiple scattering calculation is desired (ISCATT = 1) two additional subroutines OMEGA and VIM are utilized. (see Section 3 for details of the scattering model). OMEGA computes optical depth from a given level to space as the sum of both attenuation (molecular and aerosol and scattering (aerosol and Rayleigh). Aerosol absorption and extinction and Rayleigh scattering coefficients QAA, QAE, QRAY are carried in COMMON from subroutine QSCATT. Additionally, a single scattering albedo profile as a function of level is computed. An interpolation scheme creates a single scattering albedo profile as a function of optical depth which is input to subroutine VIM which performs a variational-iterative method multiple scattering calculation and returns the net flux available for photodissociation at a given optical depth normalized to the solar flux. This mean intensity includes contributions from the attenuated direct solar beam (absorption only case) and diffuse contributions reflected from the surface and scattered by molecules and aerosol particles. The surface reflectivity REF is contained in NAMELIST.

Subroutine OMEGA uses its knowledge of the altitude variation of optical depth to reinterpolate the net flux vs. optical depth profile to a net flux at altitude level profile. These values are placed in array F and returned to COMPJ for integration into the J value calculation. Subroutine VIM calls its own family of higher order subroutines which function somewhat independently of the overall CMSP code. A schematic presentation of the VIM subroutine heirarchy is presented in Table 4-3 in relation to the total CMSP sequence.

In order to account for the desired time averaging, OMEGA must be called for each GMU desired. Therefore, if a 24 hour average model is required (ISWIT = 1), OMEGA is called for each GMU using the solar zenith angles computed by WEIGHT (= 1/A) and averaging over 24 hours as was done for the absorption only case.

4.4.2 Subroutines INITAL, SOLVE: Short-lived Species

After photodissociation rates based on the first guess ozone concentrations are returned to PHOCHM by RJITER, calculations of the species concentration profiles begin. As noted in Table 4.1 the PHOCHM code sequence from this point can be divided into segments handling the short-lived species and the long-lived species. An iteration counter I is incremented by statement 10 in PHOCHM after initialization to zero. This index keeps account of the number of times the program is executed to reach convergence. An upper limit of 50 iterations is assigned. For all iterations after the first the old OH and O_3 profiles (OLDOH,003) are saved for convergence testing before being recomputed. The computed photodissociation rates of O_2, O_3, HNO_3, H_2O_2, and N_2O_5 are substituted for the BLOCK DATA values at each level and the concentration profile of

TABLE 4-3 SCHEMATIC PRESENTATION OF SUBROUTINE VIM SEQUENCE

```
MAIN
    PHOCHM
        RJITER
            COMPJ
                OMEGA
                    VIM
                        RMATRI
                        LINEQN
                        SG
                        S11
                        SE
                        S1NT
                        E
                        E2
                        E3
```

$O(^1D)$, DID, is computed based on equilibrium between the reactions;

$O_3 + h\nu \rightarrow O_2 + O(^1D)$ J = CJ031

$O(^1D) + M \rightarrow O + M$ k = RATE (51)

this yields the relationship:

DID = CJ031 *03/RATE(51) * DM

at each level.

The calculation continues with a DO loop from statement 60 to statement 100 in PHOCHM. For each level in the atmosphere concentrations of the short-lived species are computed using the INITAL and SOLVE subroutines. At a given level, INITAL sets up a non-linear system of simultaneous equations in four variables: Y(1) = H, Y(2) = OH, Y(3) = HO2, and Y(4) = 03. The Y array gives the concentration of these four species at a given level. (Note: O_3 is short-lived above 30 km and long-lived below 30 km.) Initial concentrations of CO, O_2, H_2, CH_4, C1X, NO_x, H_2O, OH, and HO2 are first evaluated from input profiles. On subsequent iterations the computed values are used. For example, mixing ratio is converted to number density by multiplying by the total number density. An iteration counter (J) is set to monitor convergence and subroutine PCLOX is called.

Subroutine PCLOX computes the level concentrations of CL, CLO, and HCL by assuming equilibrium of production and loss mechanisms. The following ratios are computed:

RRC1 = CLO/CL I

RRC2 = HCL/CL II

RRC3A = CLNO3/CLO III

RRC3B = CLNO3/CL = RRC3A * RRC1

the corresponding reaction schemes assuming steady state at each level are:

$Cl + O_3 \rightarrow ClO + O_2$ k = RATE(29)

$ClO + O \rightarrow Cl + O_2$ k = RATE(31) I

$ClO + NO \rightarrow Cl + NO_2$ K = RATE(32)

$O + HCl \rightarrow OH + Cl$	k = RATE(33)	
$HCl + h\nu \rightarrow H + Cl$	J = JHCL	
$Cl + CH_4 \rightarrow HCl + CH_3$	k = RATE(30)	
$Cl + H_2 \rightarrow HCl + H$	k = RATE(26)	II
$Cl + H_2O_2 \rightarrow HCl + HO_2$	k = RATE(27)	
$HO_2 + Cl \rightarrow HCl + O_2$	k = RATE(15)	
$OH + HCl \rightarrow H_2O + Cl$	k = RATE(20)	
$ClONO_2 + h\nu \rightarrow ClO + NO_2$	J = CJC103	
$ClO + NO_2 + M \rightarrow ClONO_2 + M$	k = RATE(28)	III

After PCLOX returns to INITAL, PNOX is called and an anologous computation of the level values of NO, NO2, HNO3, NO3, N205, and CLNO3 is made. The following ratios are computed:

RR1 = NO/NO2	I
RR2 = HNO3/NO2	II
RR3 = NO3/NO2	III
RR4 = N205/NO2 * NO2	IV
RR9 = CLNO3/NO2	V

Reaction schemes determining these ratios assuming steady state at each level of the atmosphere are:

$NO_2 + h\nu \rightarrow NO + O$	$J = CJNO_2$	
$NO_2 + O \rightarrow NO + O_2$	k = RATE(42)	
$ClO + NO \rightarrow Cl + NO_2$	k = RATE(32)	I
$NO + O_3 \rightarrow NO_2 + O_2$	k = RATE(40)	
$OH + NO_2 + M \rightarrow HNO_3 + M$	k = RATE(22)	
$HNO_3 + h\nu \rightarrow OH + NO_2$	J = JHNO3	II
$OH + HNO_3 \rightarrow H_2O + NO_3$	k = RATE(23)	
$NO_2 + O_3 \rightarrow NO_3 + O_2$	k = RATE(41)	III
$NO_3 + h\nu \rightarrow NO + O_2$	J = JNO3	
$N_2O_5 * + M \rightarrow N_2O_5 + M$	k = RATE(38)	
$N_2O_5 * \rightarrow NO_2 + NO_3$	k = RATE(37)	
$N_2O_5 + h\nu \rightarrow NO_2 + NO_3$	J = JN205	IV
$N_2O_5 + M \rightarrow N_2O_5 + M$	k = RATE(39)	
$NO_2 + NO_3 \rightarrow N_2O_5 *$	k = RATE(36)	

$ClONO_2 + h\nu \rightarrow ClO + NO_2$ J = CJCLO3

$ClO + NO_2 + M \rightarrow ClONO_2 + M$ k = RATE(28) V

In the course of its calculation PNOX calls subroutine QUAD which solves the quadratic equation. PNOX returns control to INITAL where a convergence test is made based on comparison of the old and new values of NO, NO2, and HNO3. If convergence occurs (within approximately 0.5%), INITAL is exited and returns to PHOCHM.

PHOCHM calls subroutine SOLVE which organizes the solution of the chemical system for the short-lived species concentrations at a given level. Basically, the quantities Y (N), N = 1,4 are solved for using the convergent values returned from PNOX and PCLOX for the odd nitrogen and odd chlorine species, respectively. An iteraction counter KK is established and the previous values of H, OH, HO2, and O3 are saved for convergence testing. Subroutine SOLVE calls subroutine JACOB which organizes the coefficients of the system of chemical equations and calculates certain relevant production and loss terms. Production and loss terms are designated by double alphabetic variable names with a single subscript, while system coefficients to be solved by LINEQN are stored in the doubly subscripted array, A. Total production terms for a given species are subscripted variables PP while loss (sink) terms are subscripted variables SS. Table 4.4 presents a key to the variables defined in JACOB, identifying each by the corresponding reactions. Note that below 30 km O_3 is treated as a long-lived species, while at or above 30 km its equilibrium chemistry is treated explicitly. Subroutine JACOB returns to SOLVE where the net imbalance:

B (J,4) = PP(J) - SS(J)

is computed for H, OH, and HO2 in addition to the cumulative error:

TABLE 4-4

CHEMICAL ORIGIN OF VARIABLES DESCRIBED IN SUBROUTINE JACOB

Variable	Definition	Reaction	
ALP	O/O_3	$O + O_2 + M \rightarrow O_3 + M$	k = RATE(34)
		$O_3 + h\nu \rightarrow O_2 + O$	J = JO3
AA(1)	Production of H	$H_2 + O(^1D) \rightarrow OH + H$	k = RATE(4)
		$H_2O + h\nu \rightarrow OH + H$	J = JH2O
AA(2)		$OH + O \rightarrow H + O_2$	k = RATE(19)
AA(3)		$OH + CO \rightarrow H + CO_2$	k = RATE(18)
AA(4)		$OH + CH_4 \rightarrow H_2O + CH_3$	k = RATE(21)
AA(5)		$OH + H_2 \rightarrow H_2O + H$	k = RATE(25)
PP(1) = AA (1) + AA(2) + AA(3) + AA(4) + AA(5)			
BB(1)	Loss of H	$H + O_2 + M \rightarrow HO_2 + M$	k = RATE(5)
BB(2)		$H + O_3 \rightarrow OH + O_2$	k = RATE(6)
BB(3)		$H + HO_2 \rightarrow H_2 + O_2$	k = RATE(16)
		$\rightarrow 2OH$	k = RATE(17)
	SS(1) = BB(1) + BB(2) + BB(3)		
CC(1)	Production of OH	$H_2O + O(^1D) \rightarrow 2OH$	k = RATE(2)
CC(2)		$CH_4 + O(^1D) \rightarrow CH_3 + OH$	k = RATE(3)
CC(3)		$O + HO_2 \rightarrow OH + O_2$	k = RATE(10)
CC(4)		$HO_2 + O_3 \rightarrow OH + 2O_2$	k = RATE(9)
CC(5)		$NO + HO_2 \rightarrow NO_2 + OH$	k = RATE(11)
CC(6)		$H_2O_2 + h\nu \rightarrow 2OH$	J = JH2O2
CC(7)		$H + O_3 \rightarrow O_2 + OH$	k = RATE(6)
CC(8)		$HNO_3 + h\nu \rightarrow NO_2 + OH$	J = JHNO3
CC(9)		$H + HO_2 \rightarrow 2OH$	k = RATE (17)
CC(10) = AA(1)			
	PP(2) = CC(1) + CC(2) + CC(3) + CC(4) + CC(5) + CC(6) + CC(7) + CC(8) + CC(9) + CC(10)		
DD(1)	Loss of OH	$OH + O_3 \rightarrow O_2 + HO_2$	k = RATE(7)
DD(2)		$H_2O_2 + OH \rightarrow H_2O + HO_2$	k = RATE(8)
DD(3)		$HO_2 + OH \rightarrow H_2O + O_2$	k = RATE(14)
DD(4) = AA(3)			
DD(5) = AA(2)			

TABLE 4-4 (Continued)

CHEMICAL ORIGIN OF VARIABLES DESCRIBED IN SUBROUTINE JACOB

Variable	Definition	Reaction	
DD(6)		$OH + HCl \rightarrow H_2O + Cl$	k = RATE(20)
DD(7)		$OH + CH_4 \rightarrow CH_3 + H_2O$	k = RATE(21)
DD(8)		$OH + NO_2 + M \rightarrow HNO_3 + M$	k = RATE(22)
DD(9)		$HNO_3 + OH \rightarrow H_2O + NO_3$	k = RATE(23)
DD(10)		$OH + OH \rightarrow H_2O + O$	k = RATE(24)
DD(11)		$OH + H_2 \rightarrow H_2O + H$	k = RATE(25)
SS(2) = DD(1) + DD(2) + DD(3) + DD(4) + DD(5) + DD(6) + DD(7) + DD(8) + DD(9) + DD(10) + DD(11)			
EE(1)	Production of HO_2	$H + O_2 + M \rightarrow HO_2 + M$	k = RATE(5)
EE(2)		$OH + O_3 \rightarrow HO_2 + O_2$	k = RATE(7)
EE(3)		$Cl + H_2O_2 \rightarrow ClO + H_2O$	k = RATE(27)
EE(4) = DD(2)			
PP(3) = EE(1) + EE(2) + EE(3) + EE(4)			
GG(1)	Loss of HO_2	$HO_2 + O_3 \rightarrow OH + 2O_2$	k = RATE(9)
GG(2) = CC(3)			
GG(3) = CC(5)			
GG(4)		$ClO + HO_2 \rightarrow HClO + O_2$	k = RATE(12)
GG(5)		$HO_2 + HO_2 \rightarrow H_2O_2 + O_2$	k = RATE(13)
GG(6) = DD(3)			
GG(7)		$Cl + HO_2 \rightarrow HCl + O_2$	k = RATE(15)
GG(8) = BB(3)			
SS(3) = GG(1) + GG(2) + GG(3) + GG(4) + GG(5) + GG(6) + GG(7) + GG(8)			
PP(4)	Production of O	$O_2 + h\nu \rightarrow 2O$	J = J02
HH(1) = BB(2)	Loss of Odd O		
HH(2) = DD(1)			
HH(3) = CC(4)			
HH(4) = CC(3)			
HH(5) = AA(2)			
HH(6)		$NO_2 + O \rightarrow NO + O_2$	k = RATE(42)
HH(7)		$ClO + O \rightarrow Cl + O_2$	k = RATE(31)
HH(8)		$O + O_3 \rightarrow 2O_2$	k = RATE(35)

TABLE 4-4 (Continued)

CHEMICAL ORIGIN OF VARIABLES DESCRIBED IN SUBROUTINE JACOB

Variable	Definition	Reaction	
	SS(4) = HH(1) + HH(2) + HH(3) + HH(4) + HH(5) + HH(6) + HH(7) + HH(8)		

COEFFICIENTS OF SYSTEM OF EQUATIONS

A(1,1) = - SS(1)/y(1)

A(1,2) = (AA(2) + AA(3) + AA(4) + AA(5))/y(2)

A(1,3) = -BB(3)/y(3)

A(2,1) = (CC(7) + CC(9)/y(1)

A(2,2) = -(SS(2) + DD(10))/y(2)

A(2,3) = (CC(3) + CC(4) + CC(5) + CC(9) -DD(3))/y(3)

A(3,1) = (EE(1) -GG(8))/y(1)

A(3,2) = (EE(2) + EE(4) -GG(6))/y(2)

A(3,3) = -(SS(3) + GG(5))/y(3)

At levels < 30 km y(4) = 03(k)

At levels $\geq$ 30 km:

T1	Loss of 0	$NO_2 + 0 \rightarrow NO + O_2$	k = RATE(42)
T2		$OH + O \rightarrow O_2 + H$	k = RATE(19)
T3		$HO_2 + 0 \rightarrow OH + O_2$	k = RATE(10)
T4		$O + ClO \rightarrow Cl + O_2$	k = RATE(31)
	TT1 = (T1 +T2 + T3 + T4) ALP		
T5	Loss of O_3	$H + O_3 \rightarrow OH + O_2$	k = RATE(6)
T6		$OH + O_3 \rightarrow HO_2 + O_2$	k = RATE(7)
T7		$HO_2 + O_3 \rightarrow OH + 2O_2$	k = RATE(9)
T8		$NO_2 + O_3 \rightarrow NO_3 + O_2$	k = RATE(41)
	TT2 = T5 + T6 + T7 + T8		
	B1 = TT1 + TT2		

$$ERR = \sum_{N=1}^{3} \left(\frac{PP(N) - SS(N)}{SS(N)} \right)^2$$

Logical function LINEQN is called to solve the system of equations B where B(J,I) for J,I = 1,3 are the A(I,J) computed in JACOB using Gaussian elimination. If the matrix of coefficients is singular, values of H, OH, and HO_2 are scaled by a factor of 0.9 to remove the singularity and the calculation is repeated from the call to subroutine JACOB in statement 1 (This is permitted up to three times). If the parameter ERR is not less than 10^{-5} the concentrations are corrected by the magnitude of the net imbalance and the calculation is repeated from statement 1. (A maximum of 20 iterations are permitted.) If neither of the above error conditions occurs, the equilibrium concentrations of H, OH, HO_2 and 03 have been found. The 0 concentration is computed using the parameter ALP from JACOB and the H202 concentration follows from the set of reactions:

$HO_2 + HO_2 \rightarrow H_2O_2 + O_2$ k = RATE(13)

$OH + H_2O_2 \rightarrow H_2O + HO_2$ k = RATE(18)

$H_2O_2 + h\nu \rightarrow 2OH$ J = JH202

H202 = RATE(13) * HO2 * HO2/(RATE(8) *OH + JH202)

Subroutines PNOX and PCLOX are called to compute the apportionment of nitrogen and chlorine species. Finally, the old and new values of H, OH, HO2, and 03 are compared. If the solutions do not compare within 1/2%, the calculation is repeated. If the solution is found, however, subroutine JACOB is called again to recompute the production and loss terms given by its coefficients (for printing purposes at final solution). Subroutine SOLVE then returns the PHOCHM. This sequence is repeated for each 2 km level in the atmosphere.

4.4.3 Subroutine CFLOW: Long-lived Species

At this stage in the calculation, concentration profiles have been computed for the short-lived species, that is the individual members of the HO_x, NO_x and ClX families, which are consistent with calculated J-values and input profiles for the long-lived species. Upon returning to PHOCHM, the values of 03 are saved for comparison and subroutine CFLOW is called to accomplish the evaluation of profiles for the long-lived species: N_2O, HO_x, NO_x, ClX, CH_4, and O_3 below 30 km. In these cases (as discussed in Section 2) it is not adequate to equate production and loss processes at each level. These species, on the contrary, have longer chemical lifetimes and their profiles must be consistent both with chemical sources and sinks at each level and the gradient of vertical flux parameterized in terms of the eddy diffusion coefficient profile. The resultant equation which must be solved for the mixing ratio f_i as a function of z is of second order with coefficients given by the vertical profiles of both production and loss and the eddy coefficients. Therefore, boundary conditions at the top (designated U) and at the bottom (designated L) of the atmosphere must be specified. Certain basic coefficients are evaluated in entry SETUP 2 of subroutine SETUP (Section 4.3.2) which is called at the beginning of PHOCHM. These arrays are essentially the product NK which appears in the definition of vertical flux (equation2.2)or in coding: CEK(I) * CDM(I). Also, at the beginning of PHOCHM are definitions for the factors PPL, PPU, and QQU which are used to specify lower and upper boundary conditions. The program offers the versatility of specifying either flux (proportional to $\frac{df_i}{dz}$ or mixing ratio (i.e. f_i boundary conditions, the basic relationship being in the form:

$$P_{L,U} \frac{df_i}{dz} + Q_{L,U} f_i = R_{L,U}$$

where f_i is the mixing ratio of the ith species at the lower (L) or upper (U) boundary. For example, if a fixed mixing ratio is to be specified at both boundaries, then $P_{L,U} = 0$, $Q_{L,U} = 1$ and $f_i = R_{L,U}$ where $R_{L,U}$ is the mixing ratio of the ith species at the lower and upper boundaries, respectively. All of the cases in the program (subroutine CFLOW) use: $P_U = 1$, Q_U = QQU * XL(N), $R_U = 0.$ where QQU = 6.0E + 05/CEK(N) * CDM(N), XL(N) is the loss frequency of level N, and N = 81 is the uppermost level or:

$$\frac{df_i}{dz} = Q_U f_i$$

for the upper boundary condition. The corresponding lower boundary condition is given by specifying R_L as either mixing ratio or flux:

(a) R_L(flux): $Q_L = 0.$, P_L = PPL = -CEK(1) * CDM(1):

$$P_L \frac{df_i}{dz} = R_K$$

(b) R_L (mixing ratio): $Q_L = 1$, $P_L = 0$:

$$f_i = R_L$$

After CFLOW is called by PHOCHM, a series of layer interpolations is accomplished using subroutine RINTER for the species: DID, OH, HO2, NO2, NO, 03, CLO, CL, H, and H20 and photodissociation rates: CJN20, CJCF3, CJCF2, CJCH3C, CJO2, CJO3, and CJCCL4. RINTER increases the vertical resolution from 2 km to 1 km using square root interpolation. The next sequence in CFLOW is a series of subroutine calls to CSPEC, each of which provides the calculation of the flow dependent (but time independent) vertical profile of a particular species. A test on the magnitude of the specified lower boundary condition (given in BLOCK DATA or namelist; see Section 4.2, TABLE 4.2 LABELLED COMMON: RLOW) determines whether flux or mixing ratio has been specified (i.e. a value greater than 1.0 is a flux while one less than 1.0 is a mixing ratio.) The appropriate boundary condition parameter is then set (Q = 0. for flux; Q = 1. for mixing ratio) for the CSPEC calculation

The order in which the individual long-lived species are handled is as follows: N_2O, NO_x, CH_4, F11, F12, CH_3Cl, CCl_4, Cl^X, and H_2. The arguments of subroutine CSPEC (see program listing, Appendix A) relate to the previous boundary conditions discussion and are in order: (P_U, R_U, P_L, Q_L, RLOW, DFP, XL, CXL). As noted above, the upper boundary conditions require $P_U = 1.$ and $R_U = 0.$ As can be seen from the listing, the first two arguments are 1. and 0., respectively. The quantity P_L is set equal to PPL (defined in (a) above) and CSPEC changes this to zero if Q_L is equal to one (for fixed lower boundary mixing ratio). The next argument is the lower boundary condition value (either flux or mixing ratio as given by Q_L. The term DFP is the time dependent term which is set equal to zero for the steady state case (in each CXL subroutine). XL is the loss frequency returned and CXL is a family of subroutines (CXL1, CXL2, etc.) which computes the level-by-level production PR and loss frequency and returns these values to CSPEC. As a reference, Table 4.5 identifies the particular species dependent reaction schemes relevant to each CXL subroutine. Next, CSPEC calls subroutine COEF which utilizes the level production and loss frequency data and the particular type of boundary conditions specified to compute the necessary coefficients to solve the system of equations resulting for a given species. The arrays AA(I) and T(I) used here can be found in SETUP2. Once, the relevant coefficients are evaluated, the system is solved by subroutine TRIDIA which computes the mixing ratio (X_i) profile for each species i. Finally, CSPEC calculates the net production and loss and returns this value (XL) to CFLOW:

```
XL = PR - XL *X
```

This procedure is carried out for each long-lived species with two exceptions. There is a convergence test for the solution of the NO_x profile

TABLE 4-5

SUBROUTINE FAMILY CXL

Subroutine	Species	Production	Loss
CXL1	N_2O	From Surface	$N_2O + O(^1D) \rightarrow N_2 + O_2$ $\rightarrow 2NO$ $N_2O + h\nu \rightarrow N_2 + O$
CXL2	NO_x	$N_2O + O(^1D) \rightarrow 2NO$	$NO + h\nu \rightarrow N + O$ $N + NO \rightarrow N_2 + O$
CXL3	CH_4	From Surface	$CH_4 + O(^1D) \rightarrow CH_3 + OH$ $CH_4 + OH \rightarrow CH_3 + CH_3 + H_2O$ $CH_4 + Cl \rightarrow CH_3 + HCl$
CXL4	$CFCl_3$	From Surface	$CFCl_3 + h\nu \rightarrow CFCl_2\ Cl$ $CFCl_3 + O(^1D) \rightarrow$ PRODUCTS
CXL5	CF_2Cl_2	From Surface	$CF_2Cl_2 + h\nu \rightarrow CF_2Cl + Cl$ $CF_2Cl_2 + O(^1D) \rightarrow$ PRODUCTS
CXL6	CH_3Cl	From Surface	$CH_3Cl + h\nu \rightarrow CH_3 + Cl$ $CH_3Cl + OH \rightarrow CH_2Cl + H_2O$
CXL7	ClX	$CFCl_3 + h\nu \rightarrow CFCl_2 + Cl$ $CF_2Cl_2 + h\nu \rightarrow CF_2Cl + Cl$ $CH_3Cl + h\nu \rightarrow CH_3 + Cl$ $CCl_4 + h\nu \rightarrow CCl_3 + Cl$	
CXL8	O_3	$O_2 + h\nu \rightarrow 2O$ $HO_2 + NO \rightarrow OH + NO_2$	$HO_2 + O_3 \rightarrow OH + 2O_2$ $OH + O_3 \rightarrow HO_2 + O_2$ $NO_2 + O \rightarrow NO + O_2$ $HO_2 + O \rightarrow OH + O_2$ $OH + O \rightarrow H + O_2$ $ClO + O \rightarrow Cl + O_2$ $O + O_3 \rightarrow 2O_2$ $NO_2 + O_3 \rightarrow NO_3 + O_2$
CXL9	CCl_4	From Surface	$CCl_4 + h\nu \rightarrow CCl_3 + Cl$
CXL11	H_2	$H_2O + O(^1D) \rightarrow 2OH$ $H + HO_2 \rightarrow H_2 + O_2$	$Cl + H_2 \rightarrow HCl + H$ $OH + H_2 \rightarrow H_2O + H$ $H_2 + O(^1D) \rightarrow OH + H$

above level 40 (39 km) where the mixing ratio profile for NO_x is given by X2. Additionally, the calculations for 03 are limited to the region from the surface to 30 km above which it is considered short-lived. There is also a convergence test for 03 whose mixing ratio profile is given by X8. If convergence is reached, subroutine REPCN is called which repeats the calculation of NO_x and ClX apportionment using the new 03 values below 30 km by calling PNOX and PC1OX. The values of ClO and NO2 are compared and if they have not converged, the 03 computations are repeated using the new ClX, NOX values. If convergence is reached, the values of the concentration profiles are computed from the resultant mixing ratios for NOX, CH4, CLX, H2, and 03 ($z \leq 30$ km), and control is returned to PHOCHM.

4.4.4 Final Convergence Testing

After return from CFLOW, the calculation is complete except for final verification of convergence. First, the previous 03 values from the short-lived calculation and those resulting from the long-lived calculation are averaged for a new profile. This is to help quicker convergence. Second, previous J values are saved since new ones (consistent with the new species profiles) will be computed for comparison. RJITER is called to accomplish this.

The final comparison is made level by level between previous and new JO3 and OH values. An accuracy of 1/10% is accepted in the latter. If not achieved, the program is directed back to statement 10 in PHOCHM which increments the iteration index by one and restarts the calculation. After successful accomplishment of the desired accuracy, the program computes the integrated 03 density (03INT) and the integrated odd 0 loss from levels 9-36 (by calling 03LINT). Finally, the major output subroutine PRINTX is called before the program is terminated.

4.5 Subroutine PRINTX: Output Profiles

Before terminating a particular run PHOCHM calls subroutine PRINTX. For each case run, thirteen pages of results are generated. (There are also a few pages of input parameters to identify the case printed out. See sample test cases Appendix C.) The beginning of the output is identifiable by the keyword RUN printed on a separate page.

Pages 1 and 2 of the output print J-values used in the final iteration of PHOCHM. They are headed with the note: "LAST ITERATION = I" where I is the final iteration index from PHOCHM. Page 1 gives the vertical profiles of the J values: CJO2, CJO3, CJCF2, CJCF3, CJO31 and in addition gives the O_3 number density, integrated O_3, integrated total number density, and the OH number density for the previous iteration. Page 2 gives the profiles of the J values: CJCLO3, CJN20, CJHNO3, CJH202, CJN205, CHCCL4, and CJCH3CL.

Pages 3-4 labelled "LAST ITERATION + 1" refer to results for the computation of J values using the final program results. Page 5 contains number densities of H,OH, HO2,H202, O, O3, and $O(^1D)$ in addition to the integrated O_3 density (HOX and odd oxygen families). Page 6 contains number densities of NO, NO2, HNO3, NO3, N205, and NOX (NOX family). Page 7 contains number densities and mixing ratios for CL, CLO, HCL, CLNO3, and CLX (CLX family).

Beginning on page 8 are level profiles of production and loss rates for particular reactions defined in PHOCHM and subroutine JACOB. (ref. Table 4-4). Page 8 in particular describes processes concerned with production and loss of odd oxygen. At the bottom of the page the integrated values of these rates are presented (they were calculated by O3LINT in PHOCHM). Page 9 gives the rates for reactives producing odd hydrogen in addition to the reaction Cl + CH_4. Page 10 gives the complementary losses of odd hydrogen.

Page 11 contains a listing of mixing ratio profiles for N20, NOX, CH_4, FC11, FC12, CH3C, CLX and CCL_4 and H2. At the bottom of this page integrated fluxes for these long-lived species are provided by integrating the net production and loss terms from subroutines CXL using by a trapezoidal rule (subroutine TRAP). These should not differ substantially from the initial flux lower boundary conditions. Page 12 gives the mixing ratio of oxygen and the number densities of FC11, FC12, CH3CL, CCL4, and CLX. Page 13 continues with N20, NOX, and CH4.

If the keyword PARAMETERS appears next in the input stream to initialize constants for the next case to continue, the program is entered and the calculation repeated for the new case. However, the keyword ENDJOB will cause the program to print "NORMAL JOB END" and it will then terminate.

5. Users Guide

5.1 Program Initiation

The input deck required to initiate a model calculation using the CMSP program is relatively simple due to its modular, self-contained nature. As discussed in Section 4.2, the basic vertical profiles, wavelength dependent spectra, and rate constants required for the calculation are incorporated within BLOCK DATA and, consequently, need not be specified for each case (unless a change is desired.) Table 5-1 illustrates the configuration of the input deck which consists for the most part of keywords specification and a title to identify the output for the case run. For added versatility, however, the user can take advantage of the NAMELIST provision of subroutine INPARM in order to modify any of the listed (Table 5.2) variables for a particular case. For a single model run including one card of NAMELIST changes, a total of eight input cards are necessary. Note that multiple cases may be run by stacking cards 3-6 for each new case before the ENDJOB card.

5.2 Default Parameter Values

In addition to listing the parameters which may be changed during input by the NAMELIST provision, Table 5-2 provides the current BLOCK DATA provided default values and subroutine location of primary utilization for each variable. Generally, these parameters may be divided into two subgroups: (1) branching parameters which control the type of calculation being made, and (2) run variables which are input data to the calculation.

The primary branching parameters are: INSWIT, ISCATT, NEDDY, and ISIZE. These have been discussed in Section 4 under the headings of their respective subroutines.

The various run variables include rate constants (RA, RB), profile multiplicative constants (FCL, FH2O, etc.), boundary condition data (RN2O, RF11, etc.), and multiple scattering factors (=1.0, they are not used)

5.3 Aerosol Model Specification

As discussed in Section 3.1, the user may select one of four internal aerosol models by specifying the parameter ISIZE which chooses a set of optical constants (extinction and absorption coefficients) in subroutine QSCATT (Section 4.3.2). An additional provision allows the user to substitute another size distribution by using ISIZE = 5 and adding the necessary extinction QE(5,J) and absorption QA(5,J) coefficients as a function of wavelength ALAM(J) within the subroutine. The height distribution specified by IAERO (Table 3-1) will be utilized for either IAERO = 0 (23 km visibility) or IAERO = 1 (5 km visibility). This parameter is set in subroutine ALTGEN (Section 4.3.1). The height distribution may be changed by amending the BLOCK DATA array DA23.

TABLE 5-1

CMSP INPUT DECK CONFIGURATION

Card Number	Description	Columns Used
1	the word TITLE	1-5
2	any title desired	1-80
3	the word PARAMETERS	1-10
4	$ INPUT	beginning in column 2
4a 4b	as many cards as necessary to input, in NAMELIST format any constants which differ from the default values set in BLOCK DATA	
5	$ END	beginning in column 2
6	the work RUN	1-3
. . .	(cards 3-6 may be repeated for any number of runs with changed constants)	
Last Card	the word ENDJOB	1-6

TABLE 5-2

PARAMETERS WHICH MAY BE SPECIFIED IN NAMELIST

Name	BLOCK DATA Default Value	Subroutine Used
FCL	1.0	INITAL
FCLNO3	1.0	PNOX
FH2O	1.0	INITAL
FNO	1.0	(not used)
FKK	1.0	SETUP
I1	59	CPHI1
P11	1.0	CPHI1
P22	1.0	CPHI1
PJO3	1.80×10^{-4}	JACOB
FJ	1.0	CXL
FJFC	1.0	CXL
TL	3.15×10^{13}	CXL
RN2O	2.50×10^{-7}	CSPEC
RNOX	2.00×10^{10}	CSPEC
RCH4	1.50×10^{-6}	CSPEC
RF11	9.30×10^{6}	CSPEC
RF12	1.30×10^{7}	CSPEC
RCH3C	1.50×10^{-9}	CSPEC
RCLX	1.00×10^{10}	CSPEC
RCCL4	1.30×10^{-10}	CSPEC
NEDDY	0	SETUP
RO3	3.00×10^{-8}	CSPEC
SCNO2	1.0	PNOX
SCCLO3	1.0	COMPJ
SCH2O2	1.0	COMPJ
SCN2O5	1.0	COMPJ
PH2O	0	CXL11
RH2	5.00×10^{-7}	CSPEC
LAT	30.	WEIGHT
DEL	0.	WEIGHT
JNO3	1.3×10^{-2}	PNOX
RA	BLOCK DATA	RCONST
RB	ARRAY	RCONST
ISWIT	1	RJITER
ISIZE	4	QSCATT
ISCATT	1	RJITER
REF	0.2	VIM

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APPENDIX A

PROGRAM LISTING

```
      PROGRAM MAIN(INPUT,OUTPUT,TAPE5=INPUT,TAPE6=OUTPUT)                000100
C.....000110
C                                                                        000120
C.............CHLORINE MODEL STUDY PROGRAM - VERSION 5                   000130
C                                                                        000140
C.....MAIN ROUTINE..READS KEYWORDS, CALLS SUBROUTINES                    000150
C                                                                        000160
C.....VERSION 5.1       LEVEL 771001                                     000170
C.....E.R.T., INC.      N.D.SIZE, N.TRIPP, R.G. ISAACS, M.K.BURKE        000180
C                                                                        000190
C                                                                        000200
C.....000210
C                                                                        000220
      REAL TITL(10),TITLE(6)                                             000230
      INTEGER KEYS(10), XT(13)                                           000240
      COMMON /HEAD/ TITLE,ICODE,VERS,LEVEL,DATE,IRUN,NPAGE,NLOG          000250
C.....000260
      DATA KEYS/4HTITL,3HRUN/                                            000270
C                                                                        000280
      ICODE=117                                                          000290
      VERS=5.0
      LEVEL=771001                                                       000310
      CALL DAY                                                           000320
C                                                                        000330
C.....READ KEYWORDS                                                     000340
C                                                                        000350
  100 CALL INPUT(KEYS,10,IC,IFORM,XT,KWN),RETURNS(999)                   000360
      GO TO (200,250,700), KWN                                           000370
C                                                                        000380
C.....TITLE - TITLE FOR OUTPUT - INITIALIZE RUN                          000390
C                                                                        000400
  200 READ(1C,1) TITL                                                    000410
      WRITE (6,3) TITL                                                   000420
      CALL ALTGEN                                                        000430
      GO TO 100                                                          000440
C                                                                        000450
C.....STEADY-STATE CALCULATIONS                                          000460
C                                                                        000470
  250 CALL PHOCHM                                                        000480
      GO TO 100                                                          000490
C                                                                        000500
  700 GO TO 100                                                          000510
C                                                                        000520
  999 WRITE (6,4)                                                        000530
C                                                                        000540
      STOP                                                               000550
    1 FORMAT(10A8)                                                       000560
    3 FORMAT(//T10,10A8)                                                 000570
    4 FORMAT(//T10,' NORMAL JOB END.')                                   000580
C                                                                        000590
C                                                                        000600
      END                                                                000610
      SUBROUTINE ALTGEN                                                  000620
C.....000630
C                                                                        000640
C.............CHLORINE MODEL STUDY PROGRAM                               000650
C                                                                        000660
C.....SUBROUTINE ALTGEN - FILLS UP ALT(-) ARRAY                          000670
C                                                                        000680
C.....VERSION 4.0       LEVEL 770214                                     000690
C.....E.R.T., INC.      L.PERRY, N.TRIPP                                 000700
C                                                                        000710
C.....000720
```

```
      COMMON /INTDEN/ DO3INT(41),DMINT(41),DAINT(41)                    000730
      COMMON  /MODEL/ ALT(41),TEMP(41),DM(41),DIU(41),DA23(41)          000740
      COMMON /SOLCON/ WL(100),FL(100),QO2(100),QO3(100)                 000750
      COMMON /SOLCN1/ QCF2(100),QCF3(100),QCCL4(100),QCH3C(100),        000760
     X QCLNO3(100),QN2O(100),QHNO3(100),QH2O2(100),QN2O5(100),          000770
     Y QHCL(100),QHOCL(100),QNO2(100),QH2O(100)                         000780
      REAL DA05(3)                                                      000790
      DATA DA05/1.378E04,1.844E03,2.453E02/                             000800
C+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++000810
C                                                                       000820
      ALT(1)=0.0                                                        000830
      DO 10 I=2,41                                                      000840
   10 ALT(I)=ALT(I-1)+2.0E5                                             000850
C                                                                       000860
      FL(29) = 1.09E+12                                                 000870
      FL(30) = 2.40E+12                                                 000880
      FL(31) = 3.75E+12                                                 000890
      FL(32) = 5.70E+12                                                 000900
      FL(33) = 1.47E+13                                                 000910
      FL(34) = 2.09E+13                                                 000920
      FL(35) = 2.59E+13                                                 000930
      FL(36) = 3.20E+13                                                 000940
C                                                                       000950
      QC_NO3(33) =  3.48E-18                                            000960
      QC_NO3(34) = 3.75E-18                                             000970
      QC_NO3(35) = 3.76E-18                                             000980
      QC_NO3(36) = 3.07E-18                                             000990
      QC_NO3(37) = 2.31E-18                                             001000
      QC_NO3(38) = 1.60E-18                                             001010
      QC_NO3(39) = 1.18E-18                                             001020
      QC_NO3(40) = 8.54E-19                                             001030
      QC_NO3(41) = 6.57E-19                                             001040
      QCL NO3(42) = 5.09E-19                                            001050
      QC_NO3(43) = 5.09E-19                                             001060
      QC_NO3(44) = 4.07E-19                                             001070
      QC_NO3(45) = 3.28E-19                                             001080
      QCL NO3(46) = 2.61E-19                                            001090
      QC_NO3(47) = 2.02E-19                                             001100
      QC_NO3(48) = 1.45E-19                                             001110
      QC_NO3(49) = 1.05E-19                                             001120
      QCL NO3(50) = 7.34E-20                                            001130
      QC_NO3(51) = 5.10E-20                                             001140
      QC_NO3(52) = 3.90E-20                                             001150
      QC_NO3(53) = 2.89E-20                                             001160
      QC_NO3(54) = 2.02E-20                                             001170
      QC_NO3(55) = 1.49E-20                                             001180
      QC_NO3(56) = 1.07E-20                                             001190
      QC_NO3(57) = 8.00E-21                                             001200
      QC_NO3(58) = 5.10E-21                                             001210
      QC_NO3(59) = 4.80E-21                                             001220
      QCL NO3(60) = 3.80E-21                                            001230
      QC_NO3(61) = 3.20E-21                                             001240
      QCL NO3(62) = 2.90E-21                                            001250
      QC_NO3(63) = 2.60E-21                                             001260
      QC_NO3(64) = 2.30E-21                                             001270
      QC_NO3(65) = 2.10E-21                                             001280
      QCL NO3(66) = 1.90E-21                                            001290
      QC_NO3(67) = 1.70E-21                                             001300
      QC_NO3(68) = 1.50E-21                                             001310
      QC_NO3(69) = 1.30E-21                                             001320
      QCL NO3(70) = 1.10E-21                                            001330
      QC_NO3(71) = 9.7E-22                                              001340
      QC_NO3(72) = 4.0E-21                                              001350
C                                                                       001360
C     AEROSOL HEIGHT MODEL  IAERO=0(23KM), =1(5KM)                      001370
C     COMPUTE INTEGRATED AEROSOL DENSITY                                001380
```

```
      IAERO=0                                                          001390
      IF(IAERO.EQ.0)GO TO 16                                           001400
      DO 15 J=1,3                                                      001410
15    DA23(J)=DA05(J)                                                  001420
16    NT = 41                                                          001430
      DAINT(NT)=DA23(NT)*3.78E05                                       001440
      NTM1 = NT - 1                                                    001450
      DELZ = 2.0E05                                                    001460
      DMINT (NT) = DM(NT) * 5.0E05                                     001470
      DO 20 J = 1,NTM1                                                 001480
      I = NT - J                                                       001490
      IP1 = I + 1                                                      001500
      DAINT(I)=DAINT(IP1)+(DA23(IP1)+DA23(I))*DELZ*.5                  001510
   20 DMINT(I) = DMINT(IP1) + (DM(IP1) + DM(I)) * DELZ*.5              001520
C                                                                      001530
      CALL PAGE                                                        001540
C                                                                      001550
      WRITE (6,601)                                                    001560
      WRITE (6,602) (J,WL(J),FL(J),QO2(J),QO3(J),QCF2(J),QCF3(J),      001570
     1               QCCL4(J),QCH3C(J),J=1,99)                         001580
      CALL PAGE                                                        001590
      WRITE (6,603)                                                    001600
      WRITE (6,604) (J,WL(J),FL(J),QCLNO3(J),QN2O(J),QHNO3(J),QH2O2(J), 001610
     1               QN2O5(J),J=1,99)                                  001620
C                                                                      001630
  601 FORMAT(1H0,12X,*WL*,11X,*FL*,10X,*QO2*,10X,*QO3*,10X,*QCF2*, 9X, 001640
     1 *QCF3*, 8X,*QCCL4*, 8X,*QCH3C*/)                                001650
  602 FORMAT (1H ,I5,1P8E13.4)                                         001660
  603 FORMAT (1H0,12X,*WL*,11X,*FL*, 9X,*QCLNO3*, 8X,*QN2O*, 8X,*QH2O2*,001670
     1  8X,*QN2O5*/)                                                   001680
  604 FORMAT (1H ,I5,1P7E13.4)                                         001690
C                                                                      001700
      RETURN                                                           001710
      END                                                              001720
      SUBROUTINE INPARM                                                001730
C.....................................................................001740
C                                                                      001750
C.....CMS04 - CHLORINE MODEL STUDY PROGRAM                             001760
C                                                                      001770
C.....SUBROUTINE INPARM - READS AND WRITES RUN VARIABLES               001780
C                                                                      001790
C.....VERSION 4.0       LEVEL 770214                                   001800
C.....E.R.T.,INC.       N.TRIPP                                        001810
C                                                                      001820
C.....................................................................001830
C                                                                      001840
      COMMON /EDDY/ FKK,I1,P11,P22,NEDDY                               001850
      COMMON /MSCAT/ SCNO2,SCCLO3,SCH2O2,SCN2O5                        001860
      COMMON /MODYD/ XH(81),XH2O(81),PH2O,RH2,X11(81)                  001870
      COMMON /PARM/ ISWIT,ISTEP,ISTOP,ILOOP,ITPRNT,ISIZE,ISCATT        001880
      REAL JNO3                                                        001890
      COMMON /RATES/ RATE(65,81),RA(65),RB(65),JNO3,PJO3               001900
      COMMON /SFACT/ FCL,FH2O,FCLNO3,FNO                               001910
      COMMON /RLOW/ RN2O,RNOX,RCH4,RF11,RF12,RCH3C,RCLX,RCCL4,RO3      001920
      COMMON /SPECON/ FJ,FJFC,TL                                       001930
      REAL LAT                                                         001940
      COMMON /WT/ A(6),DL,LAT,DEL                                      001950
      COMMON /PARA/ U0,N,N1,N2,NN,NNP1,REF                             001960
C                                                                      001970
      NAMELIST /INPUT/ FCL,FCLNO3,FH2O,FNO,FKK,I1,P11,P22,PJO3,ISWIT,  001980
     1  FJ,FJFC,TL,RN2O,RNOX,RCH4,RF11,RF12,RCH3C,RCLX,RCCL4,          001990
     2 NEDDY,RO3,SCNO2,SCCLO3,SCH2O2,SCN2O5,PH2O,RH2,LAT,DEL,JNO3,RA,RB 002000
     3 ,ISIZE,ISCATT,REF                                               002010
      READ (5,INPUT)                                                   002020
C                                                                      002030
      CALL PAGE                                                        002040
```

```
      IF (ISWIT.EQ.0) WRITE(6,510) ISWIT                                 002050
  510 FORMAT (1H0,3X, *FIXED SUN ANGLE MODEL - ISWITCH =*,I2)            002060
      IF (ISWIT.EQ.1) WRITE(6,511) ISWIT                                 002070
  511 FORMAT (1H0,3X,*24 HOUR AVERAGED MODEL - ISWITCH =*,I2)            002080
C                                                                        002090
      CALL WEIGHT                                                        002100
      WRITE (6,514) LAT,DEL,A,DL                                         002110
  514 FORMAT (1H0/4X,*COMTAU FACTORS FOR THIS RUN:*//4X,*FOR LATITUDE =*002120
     1,F5.1,*  & SOLAR DECLINATION =*,F6.1,3X,*A**S =*,6(F9.4,*,*)/     002130
     2 5X,*DL  =*,F9.1,* SECS.*)                                         002140
      IF(ISCATT.EQ.0)GO TO 10                                            002150
      WRITE(6,520)ISCATT                                                 002160
  520 FORMAT(1H0/,4X,*MULTIPLE SCATTERING CALCULATION, ISCATT=*,I2)       002170
      CALL PAGE                                                          002180
      CALL QSCATT                                                        002190
   10 CONTINUE                                                           002200
C                                                                        002210
      WRITE (6,504)                                                      002220
  504 FORMAT (1H0/4X,*FLUXES AND MIXING RATIOS FOR THIS RUN:*)           002230
      WRITE (6,506) RN2O,RNOX,RCH4,RFL1,RF12,RCH3C,RCLX,RCCL4,RO3,RH2    002240
  506 FORMAT (1H0,3X,*RN2O =*,1PE9.2,2X,*RNOX =*,E9.2,2X, *RCH4 =*,E9.2,002250
     1              2X,*RF11 =*,E9.2,2X,*RF12 =*,E9.2,2X,*RCH3C =*,E9.2,002260
     2              2X,*RCLX =*,E9.2/ 4X,*RCCL4 =*,E9.2,2X,*RO3= *,E9.2,002270
     3              2X,*RH2 =*,E9.2)                                    002280
      WRITE (6,505) JNO3,PJO3,PH2O                                       002290
  505 FORMAT (1H0//4X,*JNO3 =*,1PE9.2,4X,*PJO3 =*,E9.2,4X,*PH2O =*,E9.2)002300
C                                                                        002310
      WRITE (6,500)                                                      002320
  500 FORMAT (1H0/4X,*S-FACTORS FOR THIS RUN:*)                          002330
      WRITE (6,501) FCL,FCLNO3,FH2O,FNO                                  002340
  501 FORMAT(1H0,3X,*FCL =*,F5.2,2X,*FCLNO3 =*,F5.2,2X,*FH2O =*,F5.2,    002350
     1 2X,*FNO =*,F5.2)                                                  002360
C                                                                        002370
      WRITE (6,512)                                                      002380
  512 FORMAT (1H0/,4X,*MULTIPLE SCATTERING FACTORS FOR THIS RUN:*)       002390
      WRITE (6,513) SCNO2,SCCLO3,SCH2O2,SCN2O5                           002400
  513 FORMAT (1H0,3X,*SCNO2 =*,F5.2,2X,*SCCLO3 =*,F5.2,2X,*SCH2O2 =*,    002410
     1 F5.2,2X,*SCN2O5 =*,F5.2)                                          002420
C                                                                        002430
      CALL CPHI1 (P11,P22,I1)                                            002440
C                                                                        002450
      CALL SETUP (STEP,81)                                               002460
C                                                                        002470
      CALL RCONST                                                        002480
      RETURN                                                             002490
      END                                                                002500
      SUBROUTINE SETUP (STEP,N)                                          002510
C.....................................................................002520
C                                                                        002530
C.....CMS03 - CHLORINE MODEL STUDY PROGRAM                              002540
C                                                                        002550
C  SUBROUTINE SETUP TO TRANSFER RAW DATA WITH 41 LEVELS TO A SET OF      002560
C     NEW DATA WITH 81 LEVELS                                            002570
C  ENTRY SETUP2 TO COMPUTE CERTAIN BASIC COEFFICIENTS                    002580
C                                                                        002590
C.....VERSION 3.2       LEVEL 761222                                     002600
C.....E.R.T.,INC.       N.D.SZE, N.TRIPP                                 002610
C                                                                        002620
C.....................................................................002630
C                                                                        002640
      COMMON /COEF1/AA(81),BB(81),CC(81),DL(81),DU(81),U(81)             002650
      COMMON /EDDY/ EKK,I1,P11,P22,NEDDY                                 002660
      COMMON  /MODEL/ ALT(41),TEMP(41),DM(41),DID(41),DA23(41)           002670
      COMMON /NDATA/ CEK(81),CDM(81),CTEMP(81),CDA(81)                   002680
      COMMON /TFCTR/ FT,FA,FB,FM                                         002690
      REAL EK(41),E(81)                                                  002700
```

```
C  HUNTEN'S EDDY DIFFUSION COEFFICIENTS (MODIFIED) - UP TO 50 KMS.      002710
      DATA EK/10.00,10.00,10.00,10.00,10.00,3.00,3.00,3.00,0.26,0.33,   002720
     10.42,0.53,0.66,0.83,1.01,1.30,1.60,2.05,2.55,3.20,4.00,5.00,6.40, 002730
     28.00,10.00,12.80,16.00,20.00,25.00,31.00,38.00,50.00,62.00,75.00, 002740
     396.00,120.00,150.00,190.00,240.00,300.00,380.00/                  002750
      IF (NEDDY.EQ.1) CALL EDC1 (EK)                                    002760
      IF (NEDDY.EQ.2) CALL EDC2 (EK)                                    002770
      DO 10 I=1,41                                                      002780
      J=2*I-1                                                           002790
      CEK(J)=EK(I)*1.0E 4*FKK                                           002800
      CDM(J)=DM(I)                                                      002810
      CDA(J)=DA23(I)                                                    002820
   10 CTEMP(J)=TEMP(I)                                                  002830
      DO 15 I=1,40                                                      002840
      J=2*I                                                             002850
      IP1=I+1                                                           002860
       CEK(J)=SQRT(EK(I)*EK(IP1))*1.0E4*FKK                             002870
      CDM(J)=SQRT(DM(I)*DM(IP1))                                        002880
      CDA(J)=SQRT(DA23(I)*DA23(IP1))                                    002890
   15 CTEMP(J)=SQRT(TEMP(I)*TEMP(IP1))                                  002900
      CALL PAGE                                                         002910
      IF (NEDDY.EQ.0) WRITE (6,60) FKK                                  002920
      IF (NEDDY.EQ.1) WRITE (6,61) FKK                                  002930
      IF (NEDDY.EQ.2) WRITE (6,62) FKK                                  002940
      WRITE (6,65)                                                      002950
      WRITE (6,66) (I,ALT(I),CEK(2*I-1),CDM(2*I-1),CTEMP(2*I-1),        002960
     1 CDA(2*I-1),I=1,41)                                               002970
   60 FORMAT (1H0,9X,*FKK =*,F5.2,*, FACTOR MULTIPLYING HUNTEN'S EDDY DI002980
     1FFUSION COEFFICIENTS*)                                            002990
   61 FORMAT (1H0,9X,*FKK =*,F5.2,*, FACTOR MULTIPLYING ANALYTIC EDDY DI003000
     1FFUSION COEFFICIENTS*)                                            003010
   62 FORMAT (1H0,9X,*FKK =*,F5.2,*, FACTOR MULTIPLYING CHANG'S EDDY DI003020
     1FFUSION COEFFICIENTS*)                                            003030
   65 FORMAT (1H0/10X,*ALT*,10X,*EK*,13X,*DM*,11X,*TEMP*,13X,*DA*/)     003040
   66 FORMAT (2X,I2,0PF11.0,1P2E15.4,0PF11.2,1PE15.4)                   003050
      RETURN                                                            003060
C                                                                       003070
      ENTRY SETUP2                                                      003080
      NM1=N-1                                                           003090
      NM2=N-2                                                           003100
      DT=3.15576E7*STEP                                                 003110
      DO 32 I=1,N                                                       003120
      E(I)=CEK(I)*CDM(I)                                                003130
   32 U(I)=0.5E-10*DT/CDM(I)                                            003140
      DO 33 I=2,NM1                                                     003150
   33 CC(I)=SQRT(E(I+1)*E(I))                                           003160
      DO 34 I=2,NM2                                                     003170
   34 BB(I+1)=CC(I)                                                     003180
      BB(2)=SQRT(E(2)*E(1))                                             003190
      DO 35 I=2,NM1                                                     003200
   35 AA(I)=CC(I)+BB(I)                                                 003210
      DO 40 I=2,NM1                                                     003220
      DL(I)=U(I)*BB(I)*FA                                               003230
   40 DU(I)=U(I)*CC(I)*FA                                               003240
      RETURN                                                            003250
      END                                                               003260
      SUBROUTINE WEIGHT                                                 003270
C.....................................................................003280
C                                                                       003290
C.....CMS03 - CHLORINE MODEL STUDY PROGRAM                              003300
C                                                                       003310
C.....VERSION 3.3       LEVEL 770201                                    003320
C.....E.R.T.,INC.       N.D.SZE, N.TRIPP                                003330
C                                                                       003340
C.....................................................................003350
C                                                                       003360
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      REAL LAT                                                          003370
      COMMON /WT/ A(6),DL,LAT,DEL                                       003380
      DIMENSION T(6)                                                    003390
      DATA DTOR,RTOD/.01745329,57.29579/                                003400
C                                                                       003410
      LAT = LAT * DTOR                                                  003420
      DEL = DEL * DTOR                                                  003430
      X1 = COS(LAT) * COS(DEL)                                          003440
      X2 = SIN(LAT) * SIN(DEL)                                          003450
      DDL = ACOS(-TAN(LAT)*TAN(DEL))                                    003460
      DDL = 240. * DDL * RTOD                                           003470
      DT = DDL/6.                                                       003480
      DO 10 I = 1,6                                                     003490
      T(I) = DT/2. + (I-1)*DT                                           003500
      T(I) = (T(I)/240.) * DTOR                                         003510
      COSANG = X1*COS(T(I)) + X2                                        003520
   10 A(I) = 1.0/COSANG                                                 003530
      DL = 2.*DDL                                                       003540
      LAT = LAT * RTOD                                                  003550
      DEL = DEL * RTOD                                                  003560
      RETURN                                                            003570
      END                                                               003580
      SUBROUTINE SP4I1 (P11,P22,I1)                                     003590
      COMMON /PHIS/ PHI1(100)                                           003600
C                                                                       003610
      DO 10 J = 1,I1                                                    003620
   10 PHI1(J) = P11                                                     003630
C                                                                       003640
      I11 = I1 + 1                                                      003650
      DO 20 J = I11,72                                                  003660
   20 PHI1(J) = P22                                                     003670
C                                                                       003680
      RETURN                                                            003690
      END                                                               003700
      SUBROUTINE EDC1 (EK)                                              003710
C                                                                       003720
C  ANALYTIC EDDY DIFFUSION COEFFICIENTS (* 1.E-4)                       003730
      DIMENSION EK(41)                                                  003740
      DO 10 I=1,5                                                       003750
   10 EK(I)=10.                                                         003760
      EK(6)=3.                                                          003770
      EK(7)=3.                                                          003780
      EK(8)=3.                                                          003790
      DO 20 I=9,41                                                      003800
   20 EK(I)=.35*EXP((2*(I-1)-14)/9.55)                                  003810
      RETURN                                                            003820
      END                                                               003830
      SUBROUTINE EDC2 (EK)                                              003840
C                                                                       003850
C  CHANG'S EDDY DIFFUSION COEFFICIENTS - UP TO 50 KMS.(* 1.E-4)         003860
C                                                                       003870
      DIMENSION EK(41),CK(41)                                           003880
      DATA CK/6*30. ,                                                   003890
     1  1.8,1.2,.97,.74,.60,.50,.42,.39,.37,.37,.39,.42,.50,.61,.80,    003900
     2  1.1,1.5,2.2,3.3,5.4,9.2,17.,29.,49.,90.,155.,9*230./            003910
C                                                                       003920
      DO 10 I = 1,41                                                    003930
   10 EK(I) = CK(I)                                                     003940
      RETURN                                                            003950
      END                                                               003960
      SUBROUTINE RCONST                                                 003970
C.....................................................................003980
C                                                                       003990
C.....CMS04 - CHLORINE MODEL STUDY PROGRAM                              004000
C                                                                       004010
C.....SUBROUTINE RCONST - CALCULATES REACTION RATES FOR PROGRAM         004020
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C                                                                       004030
C.....VERSION 4.0       LEVEL 770214                                    004040
C.....E.R.T.,INC.       N.D.SZE, N.TRIPP                                004050
C                                                                       004060
C.....................................................................  004070
C                                                                       004080
      COMMON /NDATA/ CEK(81),CDM(81),CTEMP(81),CDA(81)                  004090
      REAL JNO3                                                         004100
      COMMON /RATES/ RATE(65,81),RA(65),RB(65),JNO3,PJO3                004110
      DIMENSION REACT1(7,9),REACT2(7,3),REACT3(7,3),                    004120
     1          REACT4(7,9),REACT5(7,9),REACT6(7,9),REACTS(7,63)        004130
      EQUIVALENCE (REACTS(1, 1),REACT1(1,1)),                           004140
     1            (REACTS(1,10),REACT2(1,1)),                           004150
     2            (REACTS(1,19),REACT3(1,1)),                           004160
     3            (REACTS(1,28),REACT4(1,1)),                           004170
     4            (REACTS(1,37),REACT5(1,1)),                           004180
     5            (REACTS(1,46),REACT6(1,1))                            004190
      DATA REACT1/4HOH  ,4H CH3,4HCL  ,4H   =,4H CH2,4HCL  ,4H H2O,     004200
     2            4HH2O ,4H+ O(,4H*D) ,4H   =,4H 2OH,4H   ,4H       ,  004210
     3            4HCH4 ,4H+ O(,4H*D) ,4H   =,4H CH3,4H + O,4HH    ,  004220
     4            4HH2 +,4H O(*,4HO)  ,4H   =,4H OH ,4H+ H ,4H     ,  004230
     5            4HH + ,4HO2 +,4H M  ,4H   =,4H HO2,4H + M,4H     ,  004240
     6            4HH + ,4HO3   ,4H   ,4H   =,4H OH ,4H+ O2,4H     ,  004250
     7            4HOH +,4H O3 ,4H    ,4H   =,4H HO2,4H + O,4H2    ,  004260
     8            4HOH +,4H H2O,4H2   ,4H   =,4H H2O,4H + H,4HO2   ,  004270
     9            4HHO2 ,4H+ O3,4H    ,4H   =,4H OH ,4H+ 2O,4H2   /  004280
      DATA REACT2/4HHO2 ,4H+ O ,4H     ,4H   =,4H OH ,4H+ O2,4H     ,  004290
     2            4HHO2 ,4H+ NO,4H    ,4H   =,4H OH ,4H+ NO,4H2    ,  004300
     3            4HHO2 ,4H+ CL,4HO   ,4H   =,4H HCL,4HO + ,4HO2   ,  004310
     4            4HHO2 ,4H+ HO,4H2   ,4H   =,4H H2O,4H2 + ,4HO2   ,  004320
     5            4HHO2 ,4H+ OH,4H    ,4H   =,4H H2O,4H + O,4H2    ,  004330
     6            4HHO2 ,4H+ CL,4H    ,4H   =,4H HCL,4H + O,4H2    ,  004340
     7            4HH + ,4HHO2 ,4H    ,4H   =,4H H2 ,4H+ O2,4H     ,  004350
     8            4HH + ,4HHO2 ,4H    ,4H   =,4H 2OH,4H   ,4H      ,  004360
     9            4HOH +,4H CO ,4H    ,4H   =,4H H +,4H CO2,4H     /  004370
      DATA REACT3/4HOH +,4H O  ,4H     ,4H   =,4H H +,4H O2 ,4H     ,  004380
     2            4HOH +,4H HCL,4H    ,4H   =,4H H2O,4H + C,4HL    ,  004390
     3            4HOH +,4H CH4,4H    ,4H   =,4H H2O,4H + C,4HH3   ,  004400
     4            4HOH +,4H NO2,4H + H,4H   =,4H HNO,4H3 + ,4HM    ,  004410
     5            4HOH +,4H HNO,4H3   ,4H   =,4H H2O,4H + N,4HO3   ,  004420
     6            4HOH +,4H OH ,4H    ,4H   =,4H H2O,4H + O,4H     ,  004430
     7            4HOH +,4H H2 ,4H    ,4H   =,4H H2O,4H + H,4H     ,  004440
     8            4HCL +,4H H2 ,4H    ,4H   =,4H HCL,4H + H,4H     ,  004450
     9            4HCL +,4H H2O,4H2   ,4H   =,4H HCL,4H + H,4HO2  /  004460
      DATA REACT4/4HCLO ,4H+ NO,4H2 + ,4HM =,4H CLN,4HO3 +,4H M    ,  004470
     2            4HCL +,4H O3 ,4H    ,4H   =,4H CLO,4H + O,4H2    ,  004480
     3            4HCL +,4H CH4,4H    ,4H   =,4H HCL,4H + C,4HH3   ,  004490
     4            4HCLO ,4H+ O ,4H    ,4H   =,4H CL ,4H+ O2,4H     ,  004500
     5            4HCLO ,4H+ NO,4H    ,4H   =,4H CL ,4H+ NO,4H2    ,  004510
     6            4HO + ,4HHCL ,4H    ,4H   =,4H OH ,4H+ CL,4H     ,  004520
     7            4HO + ,4HO2 +,4H M  ,4H   =,4H O3 ,4H+ M ,4H     ,  004530
     8            4HO + ,4HO3   ,4H   ,4H   =,4H 2O2,4H   ,4H      ,  004540
     9            4HNO2 ,4H+ NO,4H3   ,4H   =,4H N2O,4H5*  ,4H     /  004550
      DATA REACT5/4HN2O5,4H*    ,4H    ,4H   =,4H NO2,4H + N,4HO3   ,  004560
     2            4HN2O5,4H* + ,4HM   ,4H   =,4H N2O,4H5 + ,4HM    ,  004570
     3            4HN2O5,4H + M,4H    ,4H   =,4H N2O,4H5* +,4H M   ,  004580
     4            4HNO +,4H O3 ,4H    ,4H   =,4H NO2,4H + O,4H2    ,  004590
     5            4HNO2 ,4H+ O3,4H    ,4H   =,4H NO3,4H + O,4H2    ,  004600
     6            4HNO2 ,4H+ O ,4H    ,4H   =,4H NO ,4H+ O2,4H     ,  004610
     7            4HN2O ,4H+ O(,4H*D) ,4H   =,4H N2 ,4H+ O2,4H     ,  004620
     8            4HN2O ,4H+ O(,4H*D) ,4H   =,4H 2NO,4H   ,4H      ,  004630
     9            4HN + ,4HNO  ,4H    ,4H   =,4H N2 ,4H+ O ,4H     /  004640
      DATA REACT6/4HN + ,4HO2  ,4H     ,4H   =,4H NO ,4H+ O ,4H     ,  004650
     2            4HO(*D,4H) + ,4HCFC.,4H3 =,4H PRO,4HDUCT,4HS     ,  004660
     3            4HO(*D,4H) + ,4HCF2C,4HL3 =,4H PRO,4HDUCT,4HS    ,  004670
     4            4HO(*D,4H) + ,4HCH3C,4HL  =,4H OH ,4H+ C4,4H2CL  ,  004680
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     5             4HO(*O,4H) + ,4HCCL4,4H   =,4H PRO,4HDUCT,4HS    ,   004690
     6             4HO(*O,4H) + ,4HM   ,4H   =,4H ) +,4H M  ,4H     ,   004700
     A   21*1H /                                                        004710
C                                                                       004720
C  SET UP RATES ARRAY FOR 65 REACTIONS                                  004730
      DO 10 I = 1,65                                                    004740
      DO 10 J = 1,81                                                    004750
   10 RATE (I,J) = RA(I) * EXP(RB(I)/CTEMP(J))                          004760
C                                                                       004770
C  RE-CALCULATE RATE CONSTANTS THAT DO NOT FIT ABOVE FORMULA            004780
      DO 20 J = 1,81                                                    004790
      RATE(22,J) = 2.3E-13*EXP(880./CTEMP(J))/(2.6E16+COM(J))           004800
      RATE(37,J) = 1.0E+08*CDM(J)/(2.6E19+CDM(J)) + 1.0E7               004810
   20 CONTINUE                                                          004820
C                                                                       004830
C  PRINT OUT ALL REACTIONS AND RATE CONSTANTS A & B                     004840
      CALL PAGE                                                         004850
      WRITE (6,600)                                                     004860
  600 FORMAT (1H0,3X,*REACTION RATE (AS A FUNCTION OF ALTITUDE,Z) = A *  004870
     1,1H*,* EXP(B/TEMP(Z))*//4X,*NO.*,15X,*REACTION*,17X,*A*,11X,*B*/) 004880
C                                                                       004890
      DO 30 I = 1,21                                                    004900
   30 WRITE (6,601) I,(REACTS(N,I),N=1,7),RA(I),RB(I)                   004910
  601 FORMAT (1H ,I5,4X,7A4,1PE13.2,0PF11.0)                            004920
      DO 40 I = 23,36                                                   004930
   40 WRITE (6,601) I,(REACTS(N,I),N=1,7),RA(I),RB(I)                   004940
      DO 50 I = 38,51                                                   004950
   50 WRITE (6,601) I,(REACTS(N,I),N=1,7),RA(I),RB(I)                   004960
C                                                                       004970
C  PRINT EXCEPTIONAL CASES                                              004980
      WRITE (6,602) (REACTS(N,22),N=1,7)                                004990
     1,             (REACTS(N,37),N=1,7)                              005000
  602 FORMAT (1H0,3X,*REACTIONS WHOSE RATES ARE CALCULATED BY DIFFERENT 005010
     1FORMULAE ARE:*//                                                  005020
     2 4X,*22*,4X,7A4,5X,*R = 2.3E-13*,1H*,                             005030
     3 *EXP(880./TEMP(Z))/(2.6E18 + M(Z))*/                            005040
     4 4X,*37*,4X,7A4,5X,*R = 1.0E+8*,1H*,                              005050
     5 *M(Z)/(2.6E19+M(Z)) + 1.0E7*)                                    005060
      RETURN                                                            005070
      END                                                               005080
      SUBROUTINE PHOCHM                                                 005090
C.....                                                                  005100
C                                                                       005110
C.....CHLORINE MODEL STUDY PROGRAM    VERSION 4                         005120
C                                                                       005130
C.....SUBROUTINE PHOCHM                                                 005140
C                                                                       005150
C.....VERSION 4.0       LEVEL 770214                                    005160
C.....E.R.T.,INC.       N. D. SZE, N.TRIPP                              005170
C                                                                       005180
C.....                                                                  005190
C                                                                       005200
      DIMENSION Y(10)                                                   005210
      COMMON /INTDEN/DO3INT(41),OMINT(41),DAINT(41)                     005220
      COMMON /JVAL/ CJO2(50),CJO3(50),CJCF2(50),CJCF3(50),CJCCL4(50),   005230
     1              CJCH3C(50),CJCLO3(50),CJN2O(50),CJHNO3(50)          005240
     2, CJH2O2(50),CJO31(50),CJN2O5(50)                                 005250
      COMMON /MODEL/ALT(41),TEMP(41),DM(41),DID(41),DA23(41)            005260
      COMMON /NDATA/ CEK(81),CDM(81),CTEMP(81),CDA(81)                  005270
      COMMON /NETPRO/ PP(4),SS(4)                                       005280
      COMMON /OLD/ OJO2(41),OJO3(41),OJCF2(41),OJCF3(41),OJCCL4(41),    005290
     1 OJCH3C(41),OJCLO3(41),OJN2O(41),OJHNO3(41),OJH2O2(41),OJO31(41), 005300
     2 OJN2O5(41),O_DOH(41),OO3INT(41),OO3(41)                          005310
      COMMON /PARA1/ STEP,QQU,PPL,PPU,N,M                               005320
      COMMON /PARM/ ISWIT,TSTEP,TSTOP,TLOOP,ITPRNT,ISIZE,ISCATT         005330
      REAL JO2, JO3, JH2O, JNO2, JN2O, JN2O5, JHNO3, JCH4, JCF2,        005340
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     X                    JCF3, JHCL, JH2O2, JHOCL                          005350
      COMMON /PHRATE/ JO2(41),JO3(41),JH2O(41),JNO2(41),JN2O(41),          005360
     X JN2O5(41),JHNO3(41),JCH4(41),JCF2(41),JCF3(41),JHCL(41),JH2O2(41)005370
     Y ,JHOCL(41)                                                         005380
      COMMON /PRORATE/ AA(10),BB(10),CC(10),DD(11),EE(10),GG(10),HH(10)   005390
      REAL JNO3                                                           005400
      COMMON /RATES/ RATE(65,81),RA(65),RB(65),JNO3,PJO3                  005410
      COMMON /SOLCON/WL(100),FL(100),XO2(100),QO3(100)                    005420
      REAL NO,NO2,NOX,NO3,N2O5                                            005430
      COMMON /SPECIE/ H(41),OH(41),HO2(41),H2O2(41),O3(41),O(41),NO(41),005440
     1 NO2(41),HNO3(41),NOX(41),CO(41),O2(41),CH4(41),H2O(41),H2(41),     005450
     2 CL(41),CLO(41),HCL(41),CLX(41),OCLX(41),NO3(41),N2O5(41),          005460
     3 CLNO3(41)                                                          005470
      COMMON /PRODS/      PODOH(7,41),SODOH(3,41),O3INT(41),CLCH4(41),    005480
     1 YY(9),HHH(9,41)                                                    005490
      DIMENSION ODO3(41)                                                  005500
C                                                                         005510
      COMMON /TFCTR/ FT,FA,FB,FM                                          005520
C  S.S. FT=0, FA=2, FB=0, FM=0;  T.D. FT=1, FA=1, FB=1, FM=1              005530
C                                                                         005540
      LOGICAL NEXT                                                        005550
      DATA NEXT/.FALSE./                                                  005560
      FT = 0.                                                             005570
      FA = 2.                                                             005580
      FB = 0.                                                             005590
      FM = 0.                                                             005600
      N1 = 31                                                             005610
      LL. = 1                                                             005620
      LLJ = 41                                                            005630
      N = 81                                                              005640
      STEP = 1.                                                           005650
      M = 1                                                               005660
      HX = 6.0E+5                                                         005670
      EPS = .001                                                          005680
      EPS1 = .01                                                          005690
      CALL SETUP2 (STEP,N)                                                005700
      QQJ =HX/(CEK(N)*CDM(N))                                             005710
      PPL = -CEK(1)*CDM(1)                                                005720
      PPJ = -CEK(N)*CDM(N)                                                005730
      CALL RJITER (ISWIT,ISCATT)                                          005740
C                                                                         005750
      I = 0                                                               005760
   10 I = I + 1                                                           005770
      IF (I.GT.50) GO TO 501                                              005780
      IF (I.EQ.1) GO TO 30                                                005790
      DO 12 J = LLL,LLU                                                   005800
      OLDOH(J) = OH(J)                                                    005810
      QO3(J) = O3(J)                                                      005820
   12 CONTINUE                                                            005830
   30 DO 40 J = LLL,LLU                                                   005840
      L = 2*J - 1                                                         005850
      JO2(J) = CJO2(J)                                                    005860
      JO3(J) = CJO3(J)                                                    005870
      JHNO3(J) = CJHNO3(J)                                                005880
      JH2O2(J) = CJH2O2(J)                                                005890
      JN2O5(J) = CJN2O5(J)                                                005900
      DIJ(J) = CJO31(J)*O3(J)/(RATE(51,L)*DM(J))                          005910
   40 CONTINUE                                                            005920
   60 DO 100 K = LLL,LLU                                                  005930
      L = 2*K - 1                                                         005940
      CALL INITAL(K,Y,I,NEXT)                                             005950
      CALL SOLVE (K,ALP,Y,N1)                                             005960
      DO 300 J = 1,9                                                      005970
  300 HHH(J,K) = HH(J)                                                    005980
      HHH(9,K) = PP(4)                                                    005990
      PODOH(1,K) = AA(1)*2.                                               006000
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      PODDH(2,K) = CC(1)                                                006010
      PODDH(3,K) = CC(2)                                                006020
      PODDH(4,K) = CC(8)                                                006030
      PODDH(5,K) = AA(3)                                                006040
      PODDH(6,K) = CC(5)                                                006050
      PODDH(7,K) = CC(6)                                                006060
      CLCH4(K) = RATE(30,L) * CL(K) * CH4(K)                            006070
      SODDH(1,K) = DD(2) * 2.                                           006080
      SODDH(2,K) = DD(3)*2.                                             006090
      DO 305 J = 3,7                                                    006100
  305 SODDH(J,K) = DD(J+3)                                              006110
      SODDH(8,K) = 2.0 * RATE(16,L) * H(K) * HO2(K)                     006120
      SODDH(9,K) = GG(7)                                                006130
  100 CONTINUE                                                          006140
C                                                                       006150
      DO 108 K = LLL,LLU                                                006160
  108 ODD3(K) = O3(K)                                                   006170
      CALL CFLOW (N1,I)                                                 006180
      DO 110 K = LLL,LLU                                                006190
  110 O3(K) = (O3(K) + ODD3(K))/2.                                      006200
C                                                                       006210
      DO 20 J = LLL,LLU                                                 006220
      OJO2(J) = CJO2(J)                                                 006230
      OJO3(J) = CJO3(J)                                                 006240
      OJCF2(J) = CJCF2(J)                                               006250
      OJCF3(J) = CJCF3(J)                                               006260
      OJCCL4(J) = CJCCL4(J)                                             006270
      OJCH3C(J) = CJCH3C(J)                                             006280
      OJCLO3(J) = CJCLO3(J)                                             006290
      OJN2O(J) = CJN2O(J)                                               006300
      OJHNO3(J) = CJHNO3(J)                                             006310
      OJH2O2(J) = CJH2O2(J)                                             006320
      OJO31(J) = CJO31(J)                                               006330
      OJN2O5(J) = CJN2O5(J)                                             006340
      OO3INT(J) = DO3INT(J)                                             006350
   20 CONTINUE                                                          006360
      CALL RJITER (ISWIT,ISCATT)                                        006370
      IF (I.EQ.1) GO TO 10                                              006380
C                                                                       006390
      DO 50 J = LLL,LLU                                                 006400
      E = ABS((CJO3(J) - OJO3(J))/CJO3(J))                              006410
      IF (E.GE.EPS) GO TO 10                                            006420
      E1 = ABS((OH(J) - OLDOH(J))/OH(J))                                006430
      IF (E1.GE.EPS1) GO TO 10                                          006440
   50 CONTINUE                                                          006450
  502 CONTINUE                                                          006460
      CALL O3LINT (HHH,YY,9,36)                                         006470
      O3INT(LLU) = O3(LLU)*5.0E5                                        006480
      LLUML = LLU - LLL                                                 006490
      DO 310 K = 1,LLUML                                                006500
      J = LLU - K                                                       006510
      JP1 = J + 1                                                       006520
  310 O3INT(J) = O3INT(JP1) + (O3(JP1) + O3(J))*1.E5                    006530
      CALL PRINTX (I,LLL,LLU)                                           006540
      NEXT=.TRUE.                                                       006550
      RETURN                                                            006560
C                                                                       006570
  501 I = I - 1                                                         006580
      WRITE (6,601) I                                                   006590
  601 FORMAT (1H0/10X,*DID NOT CONVERGE IN*,I4,*  ITERATIONS*)          006600
      GO TO 502                                                         006610
C                                                                       006620
      END                                                               006630
      SUBROUTINE RJITER (ISWIT,ISCATT)                                  006640
C.....................................................................006650
C                                                                       006660
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C.....CMS03 - CHLORINE MODEL STUDY PROGRAM                              006670
C                                                                       006680
C.....VERSION 3.3       LEVEL 770201                                    006690
C.....E.R.T.,INC.       N.D.SZE, N.TRIPP                                006700
C                                                                       006710
C.......................................................................006720
      COMMON /RATES/RATE(65,81),RA(65),RB(65),JNO3,PJO3                 006730
C                                                                       006740
      NT = 41                                                           006750
      HAV = 5.0E05                                                      006760
      IL = 1                                                            006770
      IU = 72                                                           006780
      IF(ISCATT.EQ.1)IU=99                                              006790
      IF(ISCATT.EQ.1)PJO3=0.0                                           006800
      RDF = 1.0                                                         006810
      IF (ISWIT.EQ.0) RDF = 0.5                                         006820
      GMJ = .707                                                        006830
      CALL COLDEN (NT,HAV)                                              006840
      CALL COMPJ (IL,IU,GMU,RDF,NT,ISWIT,ISCATT)                        006850
      RETURN                                                            006860
      END                                                               006870
      SUBROUTINE COLDEN(NT,HAV)                                         006880
C                                                                       006890
C     THIS ROUTINE COMPUTES COLUMN DENSITIES OF OZONE                   006900
C                                                                       006910
C     NT   IS THE INDEX NUMBER OF THE TOP LAYER                         006920
C     HAV  IS THE AVERAGE SCALE HEIGHT OF TOP LAYER                     006930
C                                                                       006940
      REAL NO,NO2,NOX,NO3,N2O5                                          006950
      COMMON /SPECIE/ H(41),OH(41),HO2(41),H2O2(41),O3(41),O(41),NO(41),006960
     1 NO2(41),HNO3(41),NOX(41),CO(41),O2(41),CH4(41),H2O(41),H2(41),   006970
     2 CL(41),CLO(41),HCL(41),CLX(41),OCLX(41),NO3(41),N2O5(41),        006980
     3 CLNO3(41)                                                        006990
      COMMON /MODEL/ALT(41),TEMP(41),DM(41),DIO(41),DA23(41)            007000
      COMMON /INTDEN/DO3INT(41),DMINT(41),DAINT(41)                     007010
C                                                                       007020
      NTM1 = NT - 1                                                     007030
      DELZ = 2.0E05                                                     007040
      DO3INT(NT) =  O3(NT) * HAV                                        007050
      DO 10 J = 1,NTM1                                                  007060
      I = NT - J                                                        007070
      IP1 = I + 1                                                       007080
   10 DO3INT(I) = DO3INT(IP1) + ( O3(IP1) +  O3(I)) * DELZ*.5           007090
      RETURN                                                            007100
      END                                                               007110
      SUBROUTINE COMPJ (IL,IU,GMU,RDF,NT,ISWIT,ISCATT)                  007120
C.......................................................................007130
C                                                                       007140
C.....CMS03 - CHLORINE MODEL STUDY PROGRAM                              007150
C                                                                       007160
C.....VERSION 3.3       LEVEL 770201                                    007170
C.....E.R.T.,INC.       N.D.SZE, N.TRIPP                                007180
C                                                                       007190
C.......................................................................007200
C                                                                       007210
C     THIS ROUTINE COMPUTES J-VALUES, IL = LOWER LIMIT, IU = UPPER LIMIT007220
C     GMJ = SOLAR ZENITH ANGLE                                          007230
C     RDF = FLUX REDUCTION FACTOR                                       007240
C     NT = INDEX NUMBER OF TOP LAYER                                    007250
C     ISWIT = SWITCH USED IN COMPUTING TRAN FROM TAU                    007260
C     ISCATT = SWITCH FOR ABSORBING OR SCATTERING MODEL                 007270
      COMMON /MODEL/ALT(41),TEMP(41),DM(41),DIO(41),DA23(41)            007280
      COMMON /INTDEN/ DO3INT(41),DMINT(41),DAINT(41)                    007290
      COMMON /JVAL/ CJO2(50),CJO3(50),CJCF2(50),CJCF3(50),CJCCL4(50),   007300
     1              CJCH3C(50),CJCLO3(50),CJN2O(50),CJHNO3(50)          007310
     2, CJH2O2(50),CJO31(50),CJN2O5(50)                                 007320
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      COMMON /MSCAT/ SCNO2,SCCLO3,SCH2O2,SCN2O5                          007330
      COMMON /PHIS/ PHI1(100)                                            007340
      REAL JO2,JO3,JH2O,JNO2,JN2O,JN2O5,JHNO3,JCH4,JCF2,                 007350
     X JCF3,JHCL,JH2O2,JHOCL                                             007360
      COMMON /PHRATE/ JO2(41),JO3(41),JH2O(41),JNO2(41),JN2O(41),        007370
     X JN2O5(41),JHNO3(41),JCH4(41),JCF2(41),JCF3(41),JHCL(41),          007380
     Y JH2O2(41),JHOCL(41)                                               007390
      COMMON /SOLCON/ WL(100),FL(100),QO2(100),QO3(100)                  007400
      COMMON /SOLCN1/ QCF2(100),QCF3(100),QCCL4(100),QCH3C(100),         007410
     X QCLNO3(100),QN2O(100),QHNO3(100),QH2O2(100),QN2O5(100),           007420
     Y QHCL(100),QHOCL(100),QNO2(100),QH2O(100)                          007430
      REAL LAT                                                           007440
      COMMON /WT/ A(6),DL,LAT,DEL                                        007450
      COMMON/SCA/TAUINT(100),F(41,100),FAV(41,100),FLUX(41)              007460
      DIMENSION PHI(100)                                                 007470
C                                                                        007480
C     COMPUTE COLUMN DENSITIES, STORED IN DO3INT,DMINT,                  007490
C        COMPUTED IN SUBROUTINE COLDEN                                   007500
C     IF ISWITCH THEN FIX GMU FOR INTEGRAL ELSE CALL COMPTAU             007510
C     IF ISCATT DO MULTIPLE SCATTERING CALCULATION AND                   007520
C     WEIGHT FLUX FACTORS IF ISWIT                                       007530
      PO2 = 0.21                                                         007540
      IF(ISCATT.EQ.0)GO TO 50                                            007550
      IF(ISWIT.EQ.0)GO TO 60                                             007560
      DO 65 I=1,NT                                                       007570
      DO 66 J=IL,IU                                                      007580
      FAV(I,J)=0.0                                                       007590
      F(I,J)=0.0                                                         007600
66    CONTINUE                                                           007610
65    CONTINUE                                                           007620
      DO 70 KK=1,5                                                       007630
      GMU=1./A(KK)                                                       007640
      CALL OMEGA(NT,IL,IU,GMU)                                           007650
      DO 80 I=1,NT                                                       007660
      DO 90 J=IL,IU                                                      007670
      FAV(I,J)=FAV(I,J)+F(I,J)                                           007680
90    CONTINUE                                                           007690
80    CONTINUE                                                           007700
70    CONTINUE                                                           007710
      DO 75 I=1,NT                                                       007720
      DO 76 J=IL,IU                                                      007730
      F(I,J)=FAV(I,J)*DL*2./1036800.                                     007740
76    CONTINUE                                                           007750
75    CONTINUE                                                           007760
      GO TO 50                                                           007770
60    CALL OMEGA(NT,IL,IU,GMU)                                           007780
50    CONTINUE                                                           007790
      DO 10 I=1,NT                                                       007800
      TEMP2 = 0.0                                                        007810
      TEMP3 = 0.0                                                        007820
      TEMP4 = 0.0                                                        007830
      TEMP5 = 0.0                                                        007840
      TEMP6 = 0.0                                                        007850
      TEMP7 = 0.0                                                        007860
      TEMP8 = 0.                                                         007870
      TEMP9 = 0.                                                         007880
      TEMP10 = 0.                                                        007890
      TEMP11 = 0.                                                        007900
      TEMP12 = 0.                                                        007910
      TEMP13=0.                                                          007920
      TEMP14=0.                                                          007930
      TEMP15=0.                                                          007940
      TEMP16=0.                                                          007950
      DO 20 J = I.,IU                                                    007960
      IF(ISCATT.EQ.1)GO TO 7                                             007970
      TAJ = QO3(J)*DO3INT(I) + QO2(J)*DMINT(I)*PO2                       007980
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      IF (ISMIT.GT.0) GO TO 100                                          007390
      TAU = -TAU/SMU                                                     008800
      IF (TAU.GE.-150.) GO TO 5                                          008010
      TRAN = 0.                                                          008020
      GO TO 6                                                            008030
    5 TRAN = EXP(TAU)                                                    008040
      GO TO 6                                                            008050
  100 CALL COMTAU (TAU,TRAN)                                             008060
      TRAN = TRAN*(DL/1036800.)                                          008070
      GO TO 6                                                            008080
    7 TRAN=F(I,J)                                                        008090
    6 TEMP2 = TEMP2 + FL(J)*QO2(J)*TRAN                                  008100
      TEMP3 = TEMP3 + FL(J)*QO3(J)*TRAN                                  008110
      TEMP4 = TEMP4 + FL(J)*QCF2(J) * TRAN                               008120
      TEMP5 = TEMP5 + FL(J)*QCF3(J) * TRAN                               008130
      TEMP6 = TEMP6 + FL(J)*QCCL4(J)* TRAN                               008140
      TEMP7 = TEMP7 + FL(J)*QCH3C(J)* TRAN                               008150
      TEMP8 = TEMP8 + FL(J)*QCLNO3(J)*TRAN*PHI1(J)                       008160
      TEMP9 = TEMP9 + FL(J)*QN2O(J)*TRAN                                 008170
      TEMP10=TEMP10 + FL(J)*QHNO3(J)*TRAN                                008180
      TEMP11 = TEMP11 + FL(J)*QH2O2(J)*TRAN                              008190
      TEMP12 = TEMP12 + FL(J)*QN2O5(J)*TRAN                              008200
      TEMP13=TEMP13 + FL(J)*QHCL(J)*TRAN                                 008210
      TEMP14=TEMP14 + FL(J)*QHOCL(J)*TRAN                                008220
      TEMP15=TEMP15 + FL(J)*QNO2(J)*TRAN                                 008230
      TEMP16=TEMP16 + FL(J)*QH2O(J)*TRAN                                 008240
   20 CONTINUE                                                           008250
      CJO2(I) = TEMP2*RDF                                                008260
      CJO3(I) = TEMP3*RDF                                                008270
      CJCF2(I)  = TEMP4*RDF                                              008280
      CJCF3(I)  = TEMP5*RDF                                              008290
      CJCCL4(I) = TEMP6*RDF                                              008300
      CJCH3C(I) = TEMP7*RDF                                              008310
      CJCLO3(I) = TEMP8*RDF*SCCLO3                                       008320
      CJN2O(I) = TEMP9*RDF                                               008330
      CJHNO3(I) = TEMP10*RDF                                             008340
      CJH2O2(I) = TEMP11*RDF*SCH2O2                                      008350
      CJN2O5(I) = TEMP12*RDF*SCN2O5                                      008360
      JHCL(I)=TEMP13*RDF                                                 008370
      JHOCL(I)=TEMP14*RDF                                                008380
      JNO2(I)=TEMP15*RDF                                                 008390
      JH2O(I)=TEMP16*RDF                                                 008400
   10 CONTINUE                                                           008410
      PHI(53) = .7                                                       008420
      PHI(54) = .05                                                      008430
      DO 30 I = 1,NT                                                     008440
      TEMP31 = 0.                                                        008450
      DO 40 J = IL,54                                                    008460
      IF (ISCATT.EQ.1) GO TO 110                                         008470
      TAJ = QO3(J)*DO3INT(I) + QO2(J)*DMINT(I)*PO2                       008480
      IF (ISMIT .GT. 0) GO TO 25                                         008490
      TAU=-TAU/GMJ                                                       008500
      IF (TAU .GE. -150.) GO TO 24                                       008510
      TRAN=0.                                                            008520
      GO TO 27                                                           008530
   24 TRAN=EXP(TAU)                                                      008540
      GO TO 27                                                           008550
   25 CALL COMTAU (TAU,TRAN)                                             008560
      TRAN = TRAN*(DL/1036800.)                                          008570
      GO TO 27                                                           008580
  110 TRAN=F(I,J)                                                        008590
   27 IF (J.GT.52) GO TO 40                                              008500
      PHI(J) = 1.0                                                       008510
   40 TEMP31 = TEMP31 + FL(J)*PHI(J)*QO3(J)*TRAN                         008620
   30 CJO31(I) = TEMP31*RDF                                              008530
      LLL=1                                                              008640
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      LLJ=NT                                                            008650
      WRITE (6,1601)                                                    008660
      WRITE (6,602) (ALT(J),CJO2(J),CJO3(J),CJCF2(J),CJCF3(J),CJO31(J), 008670
     1              JHCL(J), JHOCL(J),JNO2(J),JH2O(J),  J=LLL,LLU)      008680
      WRITE (6,1603)                                                    008690
      WRITE (6,604) (ALT(J),CJCLO3(J),CJN2O(J),CJHNO3(J),CJH2O2(J),     008700
     1 CJN2O5(J),CJCCL4(J),CJCH3C(J),J=LLL,LLU)                         008710
 1601 FORMAT (1H0,5X,*LAST ITERATION  =  1*    // 5X,*ALT*,6X,*CJO2*, 7X,008720
     1 *CJO3*, 6X,*CJCF2*, 6X,*CJCF3*,6X,*CJO 31*,5X,*  JHCL*,5X,       008730
     2 * JHOCL*,5X,* JNO2*,6X,*  JH2O*//)                               008740
  602 FORMAT (1H ,0PF9.0, 1P09E11.3)                                    008750
 1603 FORMAT (1H0,5X,*LAST ITERATION  =  1*//                           008760
     A                                  6X,*ALT*,5X,*CJCLO3*,5X,*CJN2O*,008770
     1 6X,*CJHNO3*,5X,*CJH2O2*,5X,*CJN2O5*,5X,*CJCCL4*,4X,*CJCH3CL*//)  008780
  604 FORMAT (1H ,0PF9.0, 1P07E11.3)                                    008790
      RETURN                                                            008800
      END                                                               008810
      SUBROUTINE CONTAU (TAU,TRAN)                                      008820
C.....................................................................008830
C                                                                       008840
C.....CMS03 - CHLORINE MODEL STUDY PROGRAM                              008850
C                                                                       008860
C.....VERSION 3.3       LEVEL 770201                                    008870
C.....E.R.T., INC.      N.D.SZE, N.TRIPP                                008880
C                                                                       008890
C.....................................................................008900
C                                                                       008910
      REAL LAT                                                          008920
      COMMON /WT/ A(6),DL,LAT,DEL                                       008930
      IF (TAU.GT.1.E-3) GO TO 10                                        008940
      TRAN = DL/3600.                                                   008950
      RETURN                                                            008960
C                                                                       008970
   10 TRAN = 0.0                                                        008980
      IF (TAU.GT.50.0) RETURN                                           008990
      T = -TAU * A(1)                                                   009000
C     TEST FOR UNDERFLOW                                                009010
      IF (T.LT.-100.0) RETURN                                           009020
      TRAN = EXP(T) * 2.0                                               009030
      T = -TAU * A(2)                                                   009040
      IF (T.LT.-100.0) RETURN                                           009050
      TRAN = TRAN + 2.0 * EXP(T)                                        009060
      T = -TAU * A(3)                                                   009070
      IF (T.LT.-100.) RETURN                                            009080
      TRAN = TRAN + 2.0 * EXP(T)                                        009090
      T = -TAU * A(4)                                                   009100
      IF (T.LT.-100.) RETURN                                            009110
      TRAN = TRAN + 2.0 * EXP(T)                                        009120
      T = -TAU * A(5)                                                   009130
      IF (T.LT.-100.) RETURN                                            009140
      TRAN = TRAN + 2.0 * EXP(T)                                        009150
      T = -TAU * A(6)                                                   009160
      IF (T.LT.-100.) RETURN                                            009170
      TRAN = TRAN + 2.0 * EXP(T)                                        009180
      RETURN                                                            009190
      END                                                               009200
      SUBROUTINE INITAL (K,Y,II,NEXT)                                   009210
C                                                                       009220
      DIMENSION Y(10),RR(3)                                             009230
      REAL NO,NO2,NOX,NO3,N2O5                                          009240
      COMMON /SPECIE/ H(41),OH(41),HO2(41),H2O2(41),O3(41),O(41),NO(41),009250
     1 NO2(41),HNO3(41),NOX(41),CO(41),O2(41),CH4(41),H2O(41),H2(41),   009260
     2 CL(41),CLO(41),HCL(41),CLX(41),OCLX(41),NO3(41),N2O5(41),        009270
     3 C.NO3(41)                                                        009280
      COMMON /MODEL/ALT(41),TEMP(41),DM(41),DIO(41),DA23(41)            009290
      COMMON /SFACT/ FCL,FH2O,FCLNO3,FNO                                009300
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      LOGICAL NEXT                                                      009310
C                                                                       009320
      IF(NEXT) GO TO 10                                                 009330
      IF (II.GT.1) GO TO 10                                             009340
      FCO = 1.0                                                         009350
      CO(K) =  CO(K) * DM(K) * FCO                                      009360
      O2(K) = 0.2 * DM(K)                                               009370
      H2(K) = 0.5E-6 * DM(K)                                            009380
      CH4(K) =  CH4(K) * DM(K)                                          009390
      DCLX(K) = CLX(K) * FCL                                            009400
      CLX(K) = CLX(K) *DM(K) * FCL                                      009410
      H2O(K) =  H2O(K) * DM(K) * FH2O                                   009420
      NOX(K) =  NOX(K) * DM(K)                                          009430
      OH(K) =  OH(K) * 1.1                                              009440
      HO2(K) =  HO2(K) * 1.1                                            009450
   10 Y(1) = H(K)                                                       009460
      Y(2) = OH(K)                                                      009470
      Y(3) = HO2(K)                                                     009480
      Y(4) = O3(K)                                                      009490
      J=0                                                               009500
   20 J=J+1                                                             009510
      IF(J.GT.10)GO TO 50                                               009520
      TNO=NO(K)                                                         009530
      TNO2=NO2(K)                                                       009540
      THNO3=HNO3(K)                                                     009550
      CALL PCLOX (K)                                                    009560
      CALL PNOX(K)                                                      009570
      RR(1)=TNO/NO(K)                                                   009580
      RR(2)=TNO2/NO2(K)                                                 009590
      RR(3)=THNO3/HNO3(K)                                               009600
      DO 25 M=1,3                                                       009610
      IF(RR(M).GT.1.005.OR.RR(M).LT.0.995)GO TO 20                      009620
   25 CONTINUE                                                          009630
      RETURN                                                            009640
   50 J=J-1                                                             009650
      WRITE(6,650)J                                                     009660
  650 FORMAT(1H0,5X,*DID NOT CONVERGE IN INITAL IN *,I3,* TIMES*)       009670
      STOP                                                              009680
      END                                                               009690
      SUBROUTINE PCLOX (K)                                              009700
C                                                                       009710
      COMMON /JVA_/ CJO2(50),CJO3(50),CJCF2(50),CJCF3(50),CJCCL4(50),   009720
     1              CJCH3C(50),CJCLO3(50),CJN2O(50),CJHNO3(50)          009730
     2, CJH2O2(50),CJO31(50),CJN2O5(50)                                 009740
      COMMON /MODEL/ALT(41),TEMP(41),DM(41),DIO(41),DA23(41)            009750
      REAL JO2, JO3, JH2O, JNO2, JN2O, JN2O5, JHNO3, JCH4, JCF2,        009760
     X                JCF3, JHCL, JH2O2, JHOCL                          009770
      COMMON /PHRATE/ JO2(41),JO3(41),JH2O(41),JNO2(41),JN2O(41),       009780
     X JN2O5(41),JHNO3(41),JCH4(41),JCF2(41),JCF3(41),JHCL(41),JH2O2(41)009790
     Y ,JHOCL(41)                                                       009800
      REAL JNO3                                                         009810
      COMMON /RATES/ RATE(65,81),RA(65),RB(65),JNO3,PJO3                009820
      COMMON /SFACT/ FCL,FH2O,FCLNO3,FNO                                009830
      REAL NO,NO2,NOX,NO3,N2O5                                          009840
      COMMON /SPECIE/ H(41),OH(41),HO2(41),H2O2(41),O3(41),O(41),NO(41),009850
     1 NO2(41),HNO3(41),NOX(41),CO(41),O2(41),CH4(41),H2O(41),H2(41),   009860
     2 CL(41),CLO(41),HCL(41),CLX(41),DCLX(41),NO3(41),N2O5(41),        009870
     3 CLNO3(41)                                                        009880
C                                                                       009890
      L = 2*K - 1                                                       009900
C     RRC1 = (CLO)/(CL)                                                 009910
      RRC1 = RATE(29,L)*O3(K)/(RATE(31,L)*O(K) + RATE(32,L)*NO(K))      009920
C     RRC2 = (HCL)/(CL)                                                 009930
      RRC2 =(RATE(30,L)*CH4(K) + RATE(26,L)*H2(K) + RATE(15,L)*HO2(K) + 009940
     1 RATE(27,L)*H2O2(K))/(RATE(20,L)*OH(K) + RATE(33,L)*O(K) +JHCL(K))009950
C     RRC3A = (CLNO3)/(CLO)                                             009960
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C       RRC3B = (CLNO3)/(CL)                                              009970
        RRC3A= RATE(25,L)*NO2(K)*FCLNO3*DM(K)/CJCLO3(K)                   009980
        RRC3B = RRC3A * RRC1                                              009990
C       CLX = CL + CLO + HCL                                              010000
        CL(K) = CLX(K)/(1. + RRC1 + RRC2 + RRC3B)                         010010
        CLO(K) =RRC1*CL(K)                                                010020
        HCL(K) =RRC2*CL(K)                                                010030
        RETURN                                                            010040
        END                                                               010050
        SUBROUTINE PNOX (K)                                               010060
C                                                                         010070
        COMMON /JVAL/ CJO2(50),CJO3(50),CJCF2(50),CJCF3(50),CJCCL4(50),   010080
     1          CJCH3C(50),CJCLO3(50),CJN2O(50),CJHNO3(50)               010090
     2, CJH2O2(50),CJO31(50),CJN2O5(50)                                   010100
        COMMON /MODEL/ALT(41),TEMP(41),DM(41),DID(41),DA23(41)            010110
        COMMON /MSCAT/ SCNO2,SCCLO3,SCH2O2,SCN2O5                         010120
        REAL JO2, JO3, JH2O, JNO2, JN2O, JN2O5, JHNO3, JCH4, JCF2,        010130
     X                JCF3, JHCL, JH2O2,JHOCL                            010140
        COMMON /PHRATE/ JO2(41),JO3(41),JH2O(41),JNO2(41),JN2O(41),       010150
     X JN2O5(41),JHNO3(41),JCH4(41),JCF2(41),JCF3(41),JHCL(41),JH2O2(41)  010160
     Y ,JHOCL(41)                                                         010170
        REAL JNO3                                                         010180
        COMMON /RATES/ RATE(65,81),RA(65),RB(65),JNO3,PJO3                010190
        COMMON /SFACT/ FCL,FH2O,FCLNO3,FNO                                010200
        REAL NO,NO2,NOX,NO3,N2O5                                          010210
        COMMON /SPECIE/ H(41),OH(41),HO2(41),H2O2(41),O3(41),O(41),NO(41),010220
     1 NO2(41),HNO3(41),NOX(41),CO(41),O2(41),CH4(41),H2O(41),H2(41),     010230
     2 CL(41),CLO(41),HCL(41),CLX(41),OCLX(41),NO3(41),N2O5(41),          010240
     3 CLNO3(41)                                                          010250
C                                                                         010260
        L = 2*K - 1                                                       010270
C       RR1 = (NO)/(NO2)                                                  010280
        CJNO2 = JNO2(K) * SCNO2                                           010290
        RR1 = (CJNO2+RATE(42,L)*O(K))/(RATE(32,L)*CLO(K)+RATE(40,L)*O3(K))010300
C       RR2 = (HNO3)/(NO2)                                                010310
        RR2 = RATE(22,L)*OH(K)*DM(K)/(JHNO3(K)+RATE(23,L)*OH(K))          010320
C       RR3 = (NO3)/(NO2)                                                 010330
        RR3 = RATE(41,L)*O3(K)/JNO3                                       010340
C       RR4 = (N2O5)/(NO2)**2                                             010350
        RR6 = RATE(38,L)*DM(K)/(RATE(37,L)+RATE(38,L)*DM(K))              010360
        RR7 = RATE(37,L)/(RATE(37,L)+RATE(38,L)*DM(K))                    010370
        RR4 = RATE(36,L)*RR6/(RR7*RATE(39,L)+JN2O5(K))                    010380
        RR4 = RR3*RR4                                                     010390
C       RR9 = (CLNO3)/(NO2)                                               010400
        RR9 = RATE(28,L)*CLO(K)*FCLNO3*DM(K)/CJCLO3(K)                    010410
        A = 2.0*RR4                                                       010420
        B = 1. + RR1 + RR2 + RR3 + RR9                                    010430
        C = NOX(K)                                                        010440
        CALL QUAD (A,B,C,X)                                               010450
        NO2(K) = X                                                        010460
        NO(K) = X * RR1                                                   010470
        HNO3(K) = X * RR2                                                 010480
        NO3(K) = X * RR3                                                  010490
        N2O5(K) = X*X * RR4                                               010500
        CLNO3(K) = X * RR9                                                010510
   10 RETURN                                                              010520
        END                                                               010530
        SUBROUTINE QUAD(A,B,C,X)                                          010540
C       SOLVE EQ. A*X*X+B*X = C                                           010550
        DD=4.*A*C/(B*B)                                                   010560
        IF (DD .GT. .01) GO TO 10                                         010570
        X= B*(.5*DD-.125*DD*DD)                                           010580
        X=X/(2.*A)                                                        010590
        RETURN                                                            010600
   10   X= -B+SQRT(B*B+4.*A*C)                                            010610
        X=X/(2.*A)                                                        010620
```

```
      RETURN                                                            010630
      END                                                               010640
      SUBROUTINE SOLVE (K,ALP,Y,N1)                                     010650
C.....................................................................010660
C                                                                       010670
C.....CMS 04 - CHLORINE MODEL STUDY PROGRAM                            010680
C                                                                       010690
C.....SUBROUTINE SOLVE - ORGANIZES SOLUTION OF CHEMICAL SYSTEM         010700
C                                                                       010710
C.....VERSION 4.0       LEVEL 770214                                    010720
C.....E.R.T.,INC.       N. D. SZE , N. TRIPP                            010730
C                                                                       010740
C.....................................................................010750
C                                                                       010760
      REAL B                                                            010770
      COMMON /MATRIX/ B(20,21)                                          010780
      COMMON /NETPRO/ PP(4),SS(4)                                       010790
      REAL JO2, JO3, JH2O, JNO2, JN2O, JN2O5, JHNO3, JCH4, JCF2,        010800
     X                JCF3, JHCL, JH2O2, JHOCL                         010810
      COMMON /PHRATE/ JO2(41),JO3(41),JH2O(41),JNO2(41),JN2O(41),       010820
     X JN2O5(41),JHNO3(41),JCH4(41),JCF2(41),JCF3(41),JHCL(41),JH2O2(41)010830
     Y ,JHOCL(41)                                                       010840
      REAL JNO3                                                         010850
      COMMON /RATES/ RATE(65,81),RA(65),RB(65),JNO3,PJO3                010860
      REAL NO,NO2,NOX,NO3,N2O5                                          010870
      COMMON /SPECIE/ H(41),OH(41),HO2(41),H2O2(41),O3(41),O(41),NO(41),010880
     1 NO2(41),HNO3(41),NOX(41),CO(41),O2(41),CH4(41),H2O(41),H2(41),   010890
     2 CL(41),CLO(41),HCL(41),CLX(41),OCLX(41),NO3(41),N2O5(41),        010900
     3 CLNO3(41)                                                        010910
      DIMENSION Y(10), YO(10)                                           010920
      LOGICAL LINEQN                                                    010930
C                                                                       010940
      L = 2*K - 1                                                       010950
      WASH = 1.65E-6                                                    010960
      IF (K.GE.9) WASH = 0.0                                            010970
      KKK = 0                                                           010980
      KK = 1                                                            010990
      N = 3                                                             011000
      NP1 = N + 1                                                       011010
    5 DO 10 J = 1,NP1                                                   011020
   10 YO(J) = Y(J)                                                      011030
      I = 1                                                             011040
C                                                                       011050
    1 CALL JACOB (K,ALP,Y,N1)                                           011060
      ERR = 0.                                                          011070
      DO 20 J = 1,N                                                     011080
      B(J,NP1) = PP(J) - SS(J)                                          011090
      ERR = ERR + (B(J,NP1)/SS(J))**2                                   011100
   20 CONTINUE                                                          011110
C                                                                       011120
      IF (LINEQN(N)) GO TO 50                                           011130
      IF (ABS(ERR).LE.1.E-05) GO TO 100                                 011140
      DO 55 J = 1,N                                                     011150
   55 Y(J) = Y(J) - B(J,NP1)                                            011160
      I = I + 1                                                         011170
      IF (I.GT.20) GO TO 101                                            011180
      GO TO 1                                                           011190
C                                                                       011200
  100 CONTINUE                                                          011210
      KK = KK + 1                                                       011220
      H(K) = Y(1)                                                       011230
      OH(K) = Y(2)                                                      011240
      HO2(K) = Y(3)                                                     011250
      O3(K) = Y(4)                                                      011260
      O(K) = ALP*Y(4)                                                   011270
      H2O2(K) = RATE(13,L)*Y(3)*Y(3)/(RATE(8,L)*Y(2)+JH2O2(K)+WASH)     011280
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      CALL PCLOX (K)                                                    011290
      CALL PNOX(K)                                                      011300
      IF (KK.GE.50) GO TO 145                                           011310
      DO 75 II = 1,4                                                    011320
      IF ((YO(II)/Y(II)).LT.0.995) GO TO 5                              011330
      IF ((YO(II)/Y(II)).GT.1.005) GO TO 5                              011340
   75 CONTINUE                                                          011350
      CALL JACOB (K,ALP,Y,N1)                                           011360
      RETURN                                                            011370
C                                                                       011380
  145 WRITE (6,151)                                                     011390
  151 FORMAT (/,*      KK EQUAL TO 50 - SUBROUTINE SOLVE*/)             011400
      RETURN                                                            011410
   50 WRITE (6,155)  K                                                  011420
  155 FORMAT (/,*      MATRIX SINGULAR   LEVEL = *,I3,/)                011430
      KKK = KKK + 1                                                     011440
      IF (KKK.GE.3) RETURN                                              011450
      DO 501 J = 1,N                                                    011460
  501 Y(J) = 0.9*Y(J)                                                   011470
      GO TO 1                                                           011480
  101 WRITE (6,152)                                                     011490
  152 FORMAT (/,*      DOES NOT CONVERGE - SUBROUTINE SOLVE*/)          011500
      RETURN                                                            011510
      END                                                               011520
      SUBROUTINE JACOB (K,ALP,Y,N1)                                     011530
C.....................................................................011540
C                                                                       011550
C.....CMS04 - CHLORINE MODEL STUDY PROGRAM                              011560
C                                                                       011570
C.....SUBROUTINE JACOB - FORMS JACOBIAN OF CHEMICAL SYSTEM              011580
C                                                                       011590
C.....VERSION 4.0       LEVEL 770214                                    011600
C.....E.R.T.,INC.       N. D. SZE , N. TRIPP                            011610
C                                                                       011620
C.....................................................................011630
C                                                                       011640
      DIMENSION Y(10)                                                   011650
      REAL A                                                            011660
      COMMON /MATRIX/ A(20,21)                                          011670
      COMMON /MODEL/ALT(41),TEMP(41),DM(41),DID(41),DA23(41)            011680
      COMMON /NETPRO/ PP(4),SS(4)                                       011690
      REAL JO2, JO3, JH2O, JNO2, JN2O, JN2O5, JHNO3, JCH4, JCF2,        011700
     X                JCF3, JHCL, JH2O2,JHOCL                          011710
      COMMON /PHRATE/ JO2(41),JO3(41),JH2O(41),JNO2(41),JN2O(41),       011720
     X JN2O5(41),JHNO3(41),JCH4(41),JCF2(41),JCF3(41),JHCL(41),JH2O2(41)011730
     Y ,JHOCL(41)                                                       011740
      COMMON /PRORATE/ AA(10),BB(10),CC(10),DD(11),EE(10),GG(10),HH(10) 011750
      REAL JNO3                                                         011760
      COMMON /RATES/ RATE(65,81),RA(65),RB(65),JNO3,PJO3                011770
      REAL NO,NO2,NOX,NO3,N2O5                                          011780
      COMMON /SPECIE/ H(41),OH(41),HO2(41),H2O2(41),O3(41),O(41),NO(41),011790
     1 NO2(41),HNO3(41),NOX(41),CO(41),O2(41),CH4(41),H2O(41),H2(41),   011800
     2 CL(41),CLO(41),HCL(41),CLX(41),OCLX(41),NO3(41),N2O5(41),        011810
     3 CLNO3(41)                                                        011820
C                                                                       011830
      L = 2*K - 1                                                       011840
      ALP = (JO3(K) + PJO3)/(RATE(34,L)*O2(K)*DM(K))                    011850
      AA(1) = RATE(4,L)*DID(K)*H2(K) + JH2O(K)*H2O(K)                   011860
      AA(2) = RATE(19,L)*ALP*Y(4)*Y(2)                                  011870
      AA(3) = RATE(18,L)*Y(2)*CO(K)                                     011880
      AA(4) = RATE(21,L)*CH4(K)*Y(2)                                    011890
      AA(5) = RATE(25,L)*Y(2)*H2(K)                                     011900
    5 PP(1) = AA(1) + AA(2) + AA(3) + AA(4) + AA(5)                     011910
      BB(1) = RATE(5,L)*O2(K)*DM(K)*Y(1)                                011920
      BB(2) = RATE(6,L)*Y(4)*Y(1)                                       011930
      BB(3) = (RATE(16,L) + RATE(17,L))*Y(3)*Y(1)                       011940
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 9    SS(1) = BB(1) + BB(2) + BB(3)                                          011950
 10   A(1,1)=-SS(1)/Y(1)                                                     011960
 11   A(1,2) = (AA(2) + AA(3) + AA(4) + AA(5))/Y(2)                          011970
 12   A(1,3) = -BB(3)/Y(3)                                                   011980
      CC(1) = 2.0*RATE(2,L)*DID(K)*H2)(K)                                    011990
      CC(2) = 2.0*RATE(3,L)*DID(K)*CH4(K)                                    012000
      CC(3) = RATE(10,L)*Y(4)*ALP*Y(3)                                       012010
      CC(4) = RATE(9,L)*Y(4)*Y(3)                                            012020
      CC(5) = RATE(11,L)*NO(K)*Y(3)                                          012030
 19   CC(6) = 2.0*JH2O2(K)*H2O2(K)                                           012040
      CC(7) = RATE(6,L)*Y(1)*Y(4)                                            012050
 21   CC(8) = JHNO3(K) * HNO3(K)                                             012060
      CC(9) = 2.0*RATE(17,L)*Y(1)*Y(3)                                       012070
      CC(10) = AA(1)                                                         012080
 23   PP(2) = CC(1)+CC(2)+CC(3)+CC(4)+CC(5)+CC(6)+CC(7)+CC(8)+CC(9)          012090
     1 +CC(10)                                                               012100
      DD(1) = RATE(7,L)*Y(4)*Y(2)                                            012110
      DD(2) = RATE(8,L)*H2O2(K)*Y(2)                                         012120
      DD(3) = RATE(14,L)*Y(3)*Y(2)                                           012130
 27   DD(4) = AA(3)                                                          012140
 28   DD(5) = AA(2)                                                          012150
      DD(6) = RATE(20,L)*HCL(K)*Y(2)                                         012160
      DD(7) = RATE(21,L)*CH4(K)*Y(2)                                         012170
      DD(8) = RATE(22,L)*NO2(K)*OH(K)*Y(2)                                   012180
      DD(9) = RATE(23,L)*HNO3(K)*Y(2)                                        012190
      DD(10) = 2.0*RATE(24,L)*Y(2)*Y(2)                                      012200
      DD(11) = AA(5)                                                         012210
 34   SS(2)=DD(1)+DD(2)+DD(3)+DD(4)+DD(5)+DD(6)+DD(7)+DD(8)+DD(9)+DD(10)     012220
     1 +DD(11)                                                               012230
 35   A(2,1) = (CC(7) + CC(9))/Y(1)                                          012240
 36   A(2,2) =-(SS(2) + DD(10))/Y(2)                                         012250
 37   A(2,3) = (CC(3)+CC(4)+CC(5)+CC(3)-DD(3))/Y(3)                          012260
 39   EE(1) = BB(1)                                                          012270
 40   EE(2) = DD(1)                                                          012280
      EE(3) = RATE(27,L)*CL(K)*H2O2(K)                                       012290
      EE(4) = DD(2)                                                          012300
 42   PP(3) = EE(1) + EE(2) + EE(3) + EE(4)                                  012310
 43   GG(1) = CC(4)                                                          012320
 44   GG(2) = CC(3)                                                          012330
 45   GG(3) = CC(5)                                                          012340
      GG(4) = RATE(12,L)*CLO(K)*Y(3)                                         012350
      GG(5) = 2.0*RATE(13,L)*Y(3)*Y(3)                                       012360
 48   GG(6) = DD(3)                                                          012370
      GG(7) = RATE(15,L)*CL(K)*Y(3)                                          012380
 50   GG(8) = BB(3)                                                          012390
 51   SS(3) = GG(1)+GG(2)+GG(3)+GG(4)+GG(5)+GG(6)+GG(7)+GG(8)                012400
 52   A(3,1) = (EE(1) - GG(8))/Y(1)                                          012410
 53   A(3,2) = (EE(2) + EE(4) - GG(6))/Y(2)                                  012420
 54   A(3,3) = -(SS(3) + GG(5))/Y(3)                                         012430
 56   PP(4) = 2.0*JO2(K)*O2(K)                                               012440
 57   HH(1) = BB(2)                                                          012450
 58   HH(2) = DD(1)                                                          012460
 59   HH(3) = CC(4)                                                          012470
 60   HH(4) = CC(3)                                                          012480
 61   HH(5) = AA(2)                                                          012490
      HH(6) = 2.0*RATE(42,L)*NO2(K)*Y(4)*ALP                                 012500
      HH(7) = 2.0*RATE(31,L)*CLO(K)*ALP*Y(4)                                 012510
      HH(8) = 2.0*ALP*RATE(35,L)*Y(4)*Y(4)                                   012520
 65   SS(4) = HH(1)+HH(2)+HH(3)+HH(4)+HH(5)+HH(6)+HH(7)+HH(8)                012530
      N11 = (N1-1)/2                                                         012540
      IF (K.LE.N11) GO TO 80                                                 012550
      T1 = 2.0*RATE(42,L)*NO2(K)                                             012560
      T2 = RATE(13,L)*Y(2)                                                   012570
      T3 = RATE(10,L)*Y(3)                                                   012580
      T4 = 2.0*RATE(31,L)*CLO(K)                                             012590
      TT1=(T1+T2+T3+T4)*ALP                                                  012600
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      T5 = RATE(6,L)*Y(1)                                              012610
      T6 = RATE(7,L)*Y(2)                                              012620
      T7 = RATE(9,L)*Y(3)                                              012630
      T8 = 2.0*RATE(41,L)*NO2(K)                                       012640
      TT2=T5+T6+T7+T8                                                  012650
      B1=TT1+TT2                                                       012660
      A1 = 2.0*RATE(35,L)*ALP                                          012670
      C1=PP(4)                                                         012680
      CALL QUAD(A1,B1,C1,XX)                                           012690
      Y(4)=XX                                                          012700
      O(K) = ALP * XX                                                  012710
   70 RETURN                                                           012720
   80 Y(4) = O3(K)                                                     012730
      RETURN                                                           012740
      END                                                              012750
      SUBROUTINE OFLOW(N1,NITER)                                       012760
C                                                                      012770
C  FLOW PROGRAM FOR VARIOUS SPECIES:                                   012780
C     SP1 = N2O, SP2 = NOX, SP3 = CH4                                  012790
C     SP4 = FC11, SP5 = FC12                                           012800
C     SP6 = CH3CL, SP7 = CLX , SP8 = O3, SP9 = CCL4, SP10 = CO         012810
C  TIME-DEPENDENT TERM FOR EACH SPECIES IS DFP                         012820
C     (SHOULD ALL BE SET = 0. FOR STEADY-STATE CASE)                   012830
C                                                                      012840
      COMMON /CHLOR/ XCL(81)                                           012850
      COMMON /COEF2/ A(81),B(81),C(81),F(81),X(81)                     012860
      COMMON /INT81/ XOH(81),XDID(81),XJN2O(81),XJCF3(81),XJCF2(81),   012870
     1 XJCH3C(81),XJO2(81),XJO3(81),XHO2(81),XNO2(81),XO3(81)          012880
     2,XJCCL4(81),XCLO(81),XNO(81)                                     012890
      COMMON /ITER/ KKK                                                012900
      COMMON /JVAL/ CJO2(50),CJO3(50),CJCF2(50),CJCF3(50),CJCCL4(50),  012910
     1              CJCH3C(50),CJCLO3(50),CJN2O(50),CJHNO3(50)         012920
     2, CJH2O2(50),CJO31(50),CJN2O5(50)                                012930
      COMMON /MODEL/ALT(41),TEMP(41),DM(41),DID(41),DA23(41)           012940
      COMMON /MOLHYD/ XH(81),XH2O(81),PH2O,RH2,X11(81)                 012950
      COMMON /NDATA/ CEK(81),CDM(81),CTEMP(81),CDA(81)                 012960
      COMMON /PARA1/ STEP,QQU,PPL,PPU,N,M                              012970
      COMMON /RLOW/ RN2O,RNOX,RCH4,RF11,RF12,RCH3C,RCLX,RCCL4,RO3      012980
      REAL NO,NO2,NOX,NO3,N2O5                                         012990
      COMMON /SPECIE/ H(41),OH(41),HO2(41),H2O2(41),O3(41),O(41),NO(41),013000
     1 NO2(41),HNO3(41),NOX(41),CO(41),O2(41),CH4(41),H2O(41),H2(41),  013010
     2 CL(41),CLO(41),HCL(41),CLX(41),OCLX(41),NO3(41),N2O5(41),       013020
     3 CLNO3(41)                                                       013030
      COMMON /SPECON/ FJ,FJFC,TL                                       013040
      COMMON /XLS/ XL1(81),XL2(81),XL3(81),XL4(81),XL5(81),XL6(81),    013050
     1 XL7(81),XL8(81),XL9(81),XL10(81)                                013060
      COMMON /XXES/ X1(81),X2(81),X3(81),X4(81),X5(81),X6(81),X7(81),  013070
     1 X8(81),X9(81),X10(81)                                           013080
      DIMENSION PR1(81),PR2(81),PR3(81),PR4(81),PR5(81),PR6(81),PR7(81),013090
     1 PR8(81),PR9(81),PR10(81)                                        013100
      DIMENSION DFP1(81),DFP2(81),DFP3(81),DFP4(81),DFP5(81),DFP6(81), 013110
     1 DFP7(81),DFP8(81),DFP9(81),DFP10(81)                            013120
      DIMENSION PR11(81),XL11(81),DFP11(81)                            013130
      COMMON /TRAPH2/ XL11                                             013140
      LOGICAL CONV,OKPO3                                               013150
      EXTERNAL CXL1,CXL2,CXL3,CXL4,CXL5,CXL6,CXL7,CXL8,CXL9,CXL10,CXL11 013160
      CALL RINTER (DID,XDID)                                           013170
      CALL RINTER  (OH,XOH)                                            013180
      CALL RINTER (CJN2O,XJN2O)                                        013190
      CALL RINTER (CJCF3,XJCF3)                                        013200
      CALL RINTER (CJCF2,XJCF2)                                        013210
      CALL RINTER (CJCH3C,XJCH3C)                                      013220
      CALL RINTER (CJO2,XJO2)                                          013230
      CALL RINTER (CJO3,XJO3)                                          013240
      CALL RINTER  (HO2,XHO2)                                          013250
      CALL RINTER  (NO2,XNO2)                                          013260
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      CALL RINTER (NO,XNO)                                              013270
      CALL RINTER  (O3,XO3)                                             013280
      CALL RINTER (CJCCL4,XJCCL4)                                       013290
      CALL RINTER (CLO,XCLO)                                            013300
      CALL RINTER (CL,XCL)                                              013310
      CALL RINTER (H,XH)                                                013320
      CALL RINTER (H2O,XH2O)                                            013330
      IF (RN2O.GT.1.0) QL1 = 0.                                         013340
      IF (RN2O.LE.1.0) QL1 = 1.                                         013350
      CALL CSPEC(1.,0.,PPL,QL1,RN2O,PR1,DFP1,XL1,CXL1)                  013360
      DO 1 I = 1,N                                                      013370
    1 X1(I) = X(I)                                                      013380
      CONV = .FALSE.                                                    013390
      IF (RNOX.GT.1.0) QL2 = 0.                                         013400
      IF (RNOX.LE.1.0) QL2 = 1.                                         013410
      K1 = 1                                                            013420
      IF (NITER.GT.1) K1 = 2                                            013430
      DO 206 KKK = K1,25                                                013440
      CALL CSPEC(1.,0.,PPL,QL2,RNOX,PR2,DFP2,XL2,CXL2)                  013450
      EMAX = 0.                                                         013460
      DO 202 I = 40,81                                                  013470
      EI =ABS((X2(I)-X(I))/X(I))                                        013480
      IF (EI.GT.EMAX) EMAX = EI                                         013490
  202 CONTINUE                                                          013500
      IF (EMAX.LT.0.05)CONV = .TRUE.                                    013510
      IF (CONV) GO TO 204                                               013520
      IF (KKK.EQ.1) GO TO 204                                           013530
      DO 203 I = 1,N                                                    013540
  203 X2(I) = (X2(I) + X(I))/2.                                         013550
      GO TO 206                                                         013560
  204 DO 205 I = 1,N                                                    013570
  205 X2(I) = X(I)                                                      013580
      IF (CONV) GO TO 2                                                 013590
  206 CONTINUE                                                          013600
      GO TO 500                                                         013610
    2 CONTINUE                                                          013620
      IF (RCH4.GT.1.0) QL3 = 0.                                         013630
      IF (RCH4.LE.1.0) QL3 = 1.                                         013640
      CALL CSPEC(1.,0.,PPL,QL3,RCH4,PR3,DFP3,XL3,CXL3)                  013650
      DO 3 I = 1,N                                                      013660
    3 X3(I) = X(I)                                                      013670
      IF (RF11.GT.1.0) QL4 = 0.                                         013680
      IF (RF11.LE.1.0) QL4 = 1.                                         013690
      CALL CSPEC(1.,0.,PPL,QL4,RF11,PR4,DFP4,XL4,CXL4)                  013700
      DO 4 I = 1,N                                                      013710
    4 X4(I) = X(I)                                                      013720
      IF (RF12.GT.1.0) QL5 = 0.                                         013730
      IF (RF12.LE.1.0) QL5 = 1.                                         013740
      CALL CSPEC(1.,0.,PPL,QL5,RF12,PR5,DFP5,XL5,CXL5)                  013750
      DO 5 I = 1,N                                                      013760
    5 X5(I) = X(I)                                                      013770
      IF (RCH3C.GT.1.) QL6 = 0.                                         013780
      IF (RCH3C.LE.1.) QL5 = 1.0                                        013790
      CALL CSPEC(1.,0.,PPL,QL6,RCH3C,PR6,DFP6,XL6,CXL6)                 013800
      DO 6 I = 1,N                                                      013810
    6 X6(I) = X(I)                                                      013820
      IF (RCCL4.GT.1.) QL9 = 0.                                         013830
      IF (RCCL4.LE.1.) QL9 = 1.0                                        013840
      CALL CSPEC(1.,0.,PPL,QL9,RCCL4,PR9,DFP9,XL9,CXL9)                 013850
      DO 9 I = 1,N                                                      013860
    9 X9(I) = X(I)                                                      013870
      IF (RCLX.GT.1.0) QL7 = 0.                                         013880
      IF (RCLX.LE.1.0) QL7 = 1.0                                        013890
      CALL CSPEC(1.,0.,PPL,QL7,RCLX,PR7,DFP7,XL7,CXL7)                  013900
      DO 7 I = 1,N                                                      013910
    7 X7(I) = X(I)                                                      013920
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      IF (RH2.GT.1.0) QL11 = 0.                                          013930
      IF (RH2.LE.1.0) QL11 = 1.                                          013940
      CALL CSPEC(1.,0.,PPL,QL11,RH2,PR11,DFP11,XL11,CXL11)               013950
      DO 11 I = 1,N                                                      013960
   11 X11(I) = X(I)                                                      013970
  800 N = N1                                                             013980
      DO 801 I = 1,N                                                     013990
  801 X8(I) = XO3(I)/COM(I)                                              014000
      CONV = .FALSE.                                                     014010
      RUO3 = XO3(N1)/COM(N1)                                             014020
      IF (RO3.GT.1.0) QL8 = 0.                                           014030
      IF (RO3.LE.1.0) QL8 = 1.                                           014040
      DO 806 KK = 1,25                                                   014050
      CALL CSPEC (0.,RUO3,PPL,QL8,RO3,      PR8,DFP8,XL8,CXL8)           014060
      EMAX = 0.                                                          014070
      DO 802 I = 1,N                                                     014080
      EI =ABS((X8(I)-X(I))/X(I))                                         014090
      IF (EI.GT.EMAX) EMAX = EI                                          014100
  802 CONTINUE                                                           014110
      IF (EMAX.LT.0.01)CONV = .TRUE.                                     014120
  804 DO 805 I = 1,N                                                     014130
  805 X8(I) = X(I)                                                       014140
      IF (CONV) GO TO 8                                                  014150
  806 CONTINUE                                                           014160
      GO TO 501                                                          014170
    8 CONTINUE                                                           014180
      OKPO3 = .FALSE.                                                    014190
      CALL REPCN (N1,OKPO3)                                              014200
      IF (OKPO3) GO TO 50                                                014210
      CALL RINTER (CLO,XCLO)                                             014220
      CALL RINTER (NO2,XNO2)                                             014230
      GO TO 800                                                          014240
   50 N = 81                                                             014250
      CALL SETUP2(STEP,N)                                                014260
C                                                                        014270
      N12 = (N1 + 1)/2                                                   014280
      DO 100 J = 1,41                                                    014290
      I = 2*J - 1                                                        014300
      NOX(J) = X2(I) * COM(I)                                            014310
      CH4(J) = X3(I) * COM(I)                                            014320
      CLX(J) = X7(I) * COM(I)                                            014330
      H2(J) = X11(I) * COM(I)                                            014340
      IF (J.GT.N12) GO TO 100                                            014350
      O3(J) = X8(I) * COM(I)                                             014360
  100 CONTINUE                                                           014370
      RETURN                                                             014380
C                                                                        014390
  500 WRITE (6,600)                                                      014400
  600 FORMAT (1H0,*  X2 DOES NOT CONVERGE IN 25 ITERATIONS - CFLOW*)     014410
      STOP                                                               014420
  501 WRITE (6,601)                                                      014430
  601 FORMAT (1H0,*  X8 DOES NOT CONVERGE IN 25 ITERATIONS - CFLOW*)     014440
      STOP                                                               014450
      END                                                                014460
      SUBROUTINE RINTER (XX,XXX)                                         014470
      DIMENSION XX(50),XXX(81)                                           014480
      DO 10 I = 1,41                                                     014490
      J = 2*I - 1                                                        014500
   10 XXX(J) = XX(I)                                                     014510
C                                                                        014520
      DO 20 I = 1,40                                                     014530
      J = 2*I                                                            014540
      IP1 = I + 1                                                        014550
   20 XXX(J) = SQRT(XX(I) * XX(IP1))                                     014560
      RETURN                                                             014570
      END                                                                014580
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      SUBROUTINE CSPEC (UP,UR,P,Q,R,PR,DFP,XL,CXL)                      014590
C  FOR FIXED MIXING RATIO AT TOP  -  PU = 0, QU = 1., RU MUST BE SPECIFI014600
      COMMON /BC/ PJ,QU,RU,PL,QL,RL(1000)                               014610
      COMMON /COEF2/ A(81),B(81),C(81),F(81),X(81)                      014620
      COMMON /PARA1/ STEP,QQU,PPL,PPU,N,M                               014630
      DIMENSION PR(81),DFP(81),XL(81)                                   014640
      PU = UP                                                           014650
      RU = UR                                                           014660
      PL = P                                                            014670
      QL = Q                                                            014680
      IF (Q.EQ.1.) PL = 0.                                              014690
      RL(1) = R                                                         014700
      CALL CXL (PR,DFP,XL,N)                                            014710
      QU = 1.0                                                          014720
      IF (PU.EQ.0.) GO TO 10                                            014730
      QU = XL(N) * QQU                                                  014740
   10 CALL COEF (PR,XL,DFP)                                             014750
      CALL TRIDIA (N)                                                   014760
      DO 20 I = 1,N                                                     014770
   20 XL(I) = PR(I) - XL(I)*X(I)                                        014780
      RETURN                                                            014790
      END                                                               014800
      SUBROUTINE CXL1 (PR1,DFP1,XL1,N)                                  014810
      COMMON /INT81/ XOH(81),XDID(81),XJN2O(81),XJCF3(81),XJCF2(81),    014820
     1 XJCH3C(81),XJO2(81),XJO3(81),XH2O(81),XNO2(81),XO3(81)           014830
     2,XJCCL4(81),XCLO(81),XNO(81)                                      014840
      COMMON /NDATA/ CEK(81),CDM(81),CTEMP(81),CDA(81)                  014850
      REAL JNO3                                                         014860
      COMMON /RATES/ RATE(65,81),RA(65),RB(65),JNO3,PJO3                014870
      COMMON /SPECON/ FJ,FJFC,TL                                        014880
      COMMON /SPLOSS/ SPL1(81),SPL4(81),SPL5(81),SPL6(81),SPL9(81)      014890
      DIMENSION PR1(81),DFP1(81),XL1(81)                                014900
      DO 10 I = 1,N                                                     014910
      PR1(I) = 0.                                                       014920
      DFP1(I) = 0.                                                      014930
      XL1(I) = ((RATE(43,I) + RATE(44,I))*XDID(I) + XJN2O(I)) * CDM(I)  014940
      SPL1(I) = RATE(44,I) * XDID(I) * CDM(I)                           014950
   10 CONTINUE                                                          014960
      RETURN                                                            014970
      END                                                               014980
      SUBROUTINE CXL2 (PR2,DFP2,XL2,N)                                  014990
      COMMON /ITER/ KKK                                                 015000
      COMMON /INT81/ XOH(81),XDID(81),XJN2O(81),XJCF3(81),XJCF2(81),    015010
     1 XJCH3C(81),XJO2(81),XJO3(81),XH2O(81),XNO2(81),XO3(81)           015020
     2,XJCCL4(81),XCLO(81),XNO(81)                                      015030
      COMMON /NDATA/ CEK(81),CDM(81),CTEMP(81),CDA(81)                  015040
      REAL JNO3                                                         015050
      COMMON /RATES/ RATE(65,81),RA(65),RB(65),JNO3,PJO3                015060
      COMMON /SPECON/ FJ,FJFC,TL                                        015070
      COMMON /SPLOSS/ SPL1(81),SPL4(81),SPL5(81),SPL6(81),SPL9(81)      015080
      COMMON /XXES/ X1(81),X2(81),X3(81),X4(81),X5(81),X6(81),X7(81),   015090
     1 X8(81),X9(81),X10(81)                                            015100
      DIMENSION PR2(81),DFP2(81),XL2(81),XL2T(81)                       015110
      IF (KKK.GT.1) GO TO 8                                             015120
      DO 5 I = 1,7                                                      015130
      XL2T(I) = CDM(I)/(7.*8.64E4)                                      015140
    5 XL2(I) = XL2T(I)                                                  015150
      DO 6 I = 8,11                                                     015160
      XL2T(I) = CDM(I)/(10.*8.64E4)                                     015170
    6 XL2(I) = XL2T(I)                                                  015180
      DO 7 I = 12,81                                                    015190
      XL2T(I) = 0.0                                                     015200
    7 XL2(I) = XL2T(I)                                                  015210
    8 DO 10 I = 1,N                                                     015220
      DFP2(I) = 0.                                                      015230
      PR2(I) = 2.0*SPL1(I)*X1(I)                                        015240
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      IF (KKK.EQ.1) GO TO 10                                            015250
      XJNO = 4.0E-6*EXP((I-81)/7.0)                                     015260
      XL2(I)=(2.0*RATE(45,I)*XJNO/(RATE(46,I)*.21))*COM(I)*X2(I)+XL2T(I)015270
   10 CONTINUE                                                          015280
      RETURN                                                            015290
      END                                                               015300
      SUBROUTINE CXL3 (PR3,DFP3,XL3,N)                                  015310
      COMMON /CHLOR/ XCL(81)                                            015320
      COMMON /INT81/ XOH(81),XDID(81),XJN2O(81),XJCF3(81),XJCF2(81),    015330
     1 XJCH3C(81),XJO2(81),XJO3(81),XHO2(81),XNO2(81),XO3(81)           015340
     2,XJCCL4(81),XCLO(81),XNO(81)                                      015350
      COMMON /NDATA/ CEK(81),COM(81),CTEMP(81),CDA(81)                  015360
      REAL JNO3                                                         015370
      COMMON /RATES/ RATE(65,81),RA(65),RB(65),JNO3,PJO3                015380
      COMMON /SPECON/ FJ,FJFC,TL                                        015390
      DIMENSION PR3(81),DFP3(81),XL3(81)                                015400
      DO 10 I = 1,N                                                     015410
      PR3(I) = 0.                                                       015420
      DFP3(I) = 0.                                                      015430
      XL3(I) = (RATE(3,I)*XDID(I) + RATE(21,I)*XOH(I)) * COM(I)         015440
      XL3(I) = XL3(I) + RATE(30,I)*XCL(I)*COM(I)                        015450
   10 CONTINUE                                                          015460
      RETURN                                                            015470
      END                                                               015480
      SUBROUTINE CXL4 (PR4,DFP4,XL4,N)                                  015490
      COMMON /INT81/ XOH(81),XDID(81),XJN2O(81),XJCF3(81),XJCF2(81),    015500
     1 XJCH3C(81),XJO2(81),XJO3(81),XHO2(81),XNO2(81),XO3(81)           015510
     2,XJCCL4(81),XCLO(81),XNO(81)                                      015520
      COMMON /NDATA/ CEK(81),COM(81),CTEMP(81),CDA(81)                  015530
      REAL JNO3                                                         015540
      COMMON /RATES/ RATE(65,81),RA(65),RB(65),JNO3,PJO3                015550
      COMMON /SPECON/ FJ,FJFC,TL                                        015560
      COMMON /SPLOSS/ SPL1(81),SPL4(81),SPL5(81),SPL6(81),SPL9(81)      015570
      DIMENSION PR4(81),DFP4(81),XL4(81)                                015580
      DO 10 I = 1,N                                                     015590
      PR4(I) = 0.                                                       015600
      DFP4(I) = 0.                                                      015610
      XL4(I) = (FJ*XJCF3(I) + 1./TL + RATE(47,I)*XDID(I)) * COM(I)      015620
      SPL4(I) = XL4(I)                                                  015630
   10 CONTINUE                                                          015640
      RETURN                                                            015650
      END                                                               015660
      SUBROUTINE CXL5 (PR5,DFP5,XL5,N)                                  015670
      COMMON /INT81/ XOH(81),XDID(81),XJN2O(81),XJCF3(81),XJCF2(81),    015680
     1 XJCH3C(81),XJO2(81),XJO3(81),XHO2(81),XNO2(81),XO3(81)           015690
     2,XJCCL4(81),XCLO(81),XNO(81)                                      015700
      COMMON /NDATA/ CEK(81),COM(81),CTEMP(81),CDA(81)                  015710
      REAL JNO3                                                         015720
      COMMON /RATES/ RATE(65,81),RA(65),RB(65),JNO3,PJO3                015730
      COMMON /SPECON/ FJ,FJFC,TL                                        015740
      COMMON /SPLOSS/ SPL1(81),SPL4(81),SPL5(81),SPL6(81),SPL9(81)      015750
      DIMENSION PR5(81),DFP5(81),XL5(81)                                015760
      DO 10 I = 1,N                                                     015770
      PR5(I) = 0.                                                       015780
      DFP5(I) = 0.                                                      015790
      XL5(I) = (FJ*XJCF2(I) + 1./TL + RATE(48,I)*XDID(I)) * COM(I)      015800
      SPL5(I) = XL5(I)                                                  015810
   10 CONTINUE                                                          015820
      RETURN                                                            015830
      END                                                               015840
      SUBROUTINE CXL6 (PR6,DFP6,XL6,N)                                  015850
      COMMON /INT81/ XOH(81),XDID(81),XJN2O(81),XJCF3(81),XJCF2(81),    015860
     1 XJCH3C(81),XJO2(81),XJO3(81),XHO2(81),XNO2(81),XO3(81)           015870
     2,XJCCL4(81),XCLO(81),XNO(81)                                      015880
      COMMON /NDATA/ CEK(81),COM(81),CTEMP(81),CDA(81)                  015890
      REAL JNO3                                                         015900
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      COMMON /RATES/ RATE(65,81),RA(65),RB(65),JNO3,PJO3                015310
      COMMON /SPECON/ FJ,FJFC,TL                                        015320
      COMMON /SPLOSS/ SPL1(81),SPL4(81),SPL5(81),SPL6(81),SPL9(81)      015330
      DIMENSION PR6(81),DFP6(81),XL6(81)                                015340
      DO 10 I = 1,N                                                     015350
      PR6(I) = 0.                                                       015360
      DFP6(I) = 0.                                                      015370
      XL6(I) = (FJ*XJCH3C(I) + RATE(1,I)*XOH(I)) * CDM(I)               015380
      SPL6(I) = XL6(I)                                                  015390
   10 CONTINUE                                                          016000
      RETURN                                                            016010
      END                                                               016020
      SUBROUTINE DXL7 (PR7,DFP7,XL7,N)                                  016030
      COMMON /INT81/ XOH(81),XDID(81),XJN2O(81),XJCF3(81),XJCF2(81),    016040
     1 XJCH3C(81),XJO2(81),XJO3(81),XNO2(81),XNO2(81),XO3(81)           016050
     2,XJCCL4(81),XCLO(81),XNO(81)                                      016060
      COMMON /NDATA/ CEK(81),CDM(81),CTEMP(81),CDA(81)                  016070
      COMMON /SPECON/ FJ,FJFC,TL                                        016080
      COMMON /SPLOSS/ SPL1(81),SPL4(81),SPL5(81),SPL6(81),SPL9(81)      016090
      COMMON /XXES/ X1(81),X2(81),X3(81),X4(81),X5(81),X6(81),X7(81),   016100
     1 X8(81),X9(81),X10(81)                                            016110
      DIMENSION PR7(81),DFP7(81),XL7(81)                                016120
      DO 10 I = 1,7                                                     016130
   10 XL7(I) = CDM(I)/(7.*8.64E4)                                       016140
      DO 20 I = 8,11                                                    016150
   20 XL7(I) = CDM(I)/(10.*8.64E4)                                      016160
      DO 30 I = 12,81                                                   016170
   30 XL7(I) = 0.0                                                      016180
      DO 40 I = 1,N                                                     016190
      DFP7(I) = 0.0                                                     016200
      PR7(I) = 3.0*SPL4(I)*X4(I) + 2.0*SPL5(I)*X5(I) + SPL6(I)*X6(I)    016210
     1       + 2.0*SPL9(I)*X9(I)                                        016220
   40 CONTINUE                                                          016230
      RETURN                                                            016240
      END                                                               016250
      SUBROUTINE DXL8(PR8,DFP8,XL8,N)                                   016260
      COMMON /INT81/ XOH(81),XDID(81),XJN2O(81),XJCF3(81),XJCF2(81),    016270
     1 XJCH3C(81),XJO2(81),XJO3(81),XNO2(81),XNO2(81),XO3(81)           016280
     2,XJCCL4(81),XCLO(81),XNO(81)                                      016290
      COMMON /NDATA/ CEK(81),CDM(81),CTEMP(81),CDA(81)                  016300
      REAL JNO3                                                         016310
      COMMON /RATES/ RATE(65,81),RA(65),RB(65),JNO3,PJO3                016320
      COMMON /SFACT/ FCL,FH2O,FCLNO3,FNO                                016330
      COMMON /XXES/ X1(81),X2(81),X3(81),X4(81),X5(81),X6(81),X7(81),   016340
     1 X8(81),X9(81),X10(81)                                            016350
      DIMENSION PR8(81),DFP8(81),XL8(81),XX(81)                         016360
      DO 10 I = 1,N                                                     016370
      ALP = (XJO3(I) + PJO3)/(RATE(34,I)*.21*CDM(I)**2)                 016380
      XX(I) = XCLO(I)*ALP                                               016390
      XLA = RATE(9,I)*XNO2(I)                                           016400
      XLB = RATE(7,I)*XOH(I)                                            016410
      XLC = 2.0*RATE(42,I)*XNO2(I)*ALP                                  016420
      XLD = RATE(10,I)*XNO2(I)*ALP                                      016430
      XLE = RATE(19,I)*XO1(I)*ALP                                       016440
      XLF = 2.0*RATE(31,I)*XX(I)                                        016450
      XLG = 2.0*RATE(35,I)*ALP*CDM(I)*X8(I)                             016460
      XLH = 2.0*RATE(41,I)*XNO2(I)                                      016470
      XL8(I) = (XLA+XLB+XLC+XLD+XLE+XLF+XLG)*CDM(I)                     016480
      XL8(I)=XL8(I)+XLH*CDM(I)                                          016490
      PR8(I) = 2.0 * RATE(33,I) * CDM(I) * .21                          016500
      DFP8(I) = DFP8(I) + RATE(33,I)*XNO2(I)*XNO(I)*FNO                 016510
      DFP8(I) = 0.                                                      016520
      XL8(I) = 0.                                                       016530
      DFP8(I) = 0.                                                      016540
      XL8(I) = 0.                                                       016550
      DFP8(I) = 0.                                                      016560
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      COMMON /INT51/ XOH(81),XDID(81),XJN2O(81),XJCF3(81),XJCF2(81),
     1 XJCH3C(81),XJO2(81),XJO3(81),XH2O2(81),XNO2(81),XO3(81)
     2,XJCCL4(81),XCLO(81),XNO(81)
      COMMON /NDATA/ CEK(81),CDM(81),CTEMP(81),CDA(81)
      COMMON /SPECON/ FJ,FJFC,TL
      COMMON /SPLOSS/ SPL1(81),SPL4(81),SPL5(81),SPL6(81),SPL9(81)
      DIMENSION PR9(81),DFP9(81),XL9(81)
      DO 10 I = 1,N
      PR9(I) = 0.
      DFP9(I) = 0.
      XL9(I) = FJ*XJCCL4(I)*CDM(I)
      SPL9(I) = XL9(I)
   10 CONTINUE
      RETURN
      END
      SUBROUTINE CXL11 (PR11,DFP11,XL11,N)
      COMMON /CHLOR/ XCL(81)
      COMMON /INT31/ XOH(81),XDID(81),XJN2O(81),XJCF3(81),XJCF2(81),
     1 XJCH3C(81),XJO2(81),XJO3(81),XH2O2(81),XNO2(81),XO3(81)
     2,XJCCL4(81),XCLO(81),XNO(81)
      COMMON /MOLHYD/ XH(81),XH2O(81),PH2O,RH2,X11(81)
      COMMON /NDATA/ CEK(81),CDM(81),CTEMP(81),CDA(81)
      REAL JNO3
      COMMON /RATES/ RATE(65,81),RA(65),RB(65),JNO3,PJO3
      COMMON /SPECON/ FJ,FJFC,TL
      DIMENSION PR11(81),DFP11(81),XL11(81)
      DO 10 I = 1,N
      PR11(I) = RATE(16,I)*XH(I)*XHO2(I)+RATE(2,I)*XDID(I)*XH2O(I)*PH2O
      XL11(I) = (RATE(26,I)*XCL(I) + RATE(25,I)*XOH(I)
     1          + RATE(4,I)*XDID(I)) * CDM(I)
   10 CONTINUE
      RETURN
      END
      SUBROUTINE COEF (PR,XL,DFP)
C
C SUBROUTINE COEF TO COMPUTE ALL NEEDED VALUES FOR TRIDIA
C S.S. FT=0,FA=2,FB=0,FM=0; T.D. FT=1,FA=1,FB=1,FM=1
C EK=EDDY COEF,DM=AIR DENSITY,DF=INITIAL MIXING RATIO,N=NO.OF LAYERS
C THE VALUES OF B(1) AND C(N) ARE SPECIFIED BUT NOT USED
C
      COMMON /BC/ PJ,QU,RU,PL,QL,RL(1000)
      COMMON /COEF1/AA(81),BB(81),CC(81),DL(81),DJ(81),U(81)
      COMMON /COEF2/ A(81),B(81),C(81),F(81),X(81)
      COMMON /NDATA/ CEK(81),CDM(81),CTEMP(81),CDA(81)
      COMMON /PARA1/ STEP,QQU,PPL,PPU,N,M
      COMMON /TFCTR/ FT,FA,FB,FM
      REAL PR(81),XL(81),DFP(81),T(81),DD(81),DDR(81),S(81)
      IF (FT.EQ.1.)GO TO 5
      DO 2 I = 1,N
    2 DFP(I) = 0.
    5 DZ=1.0E+05
      DT=3.15576E7*STEP
      AA(1) = 2.0*CEK(1)*CDM(1)
      TT = AA(1)*J(1)
      NM1=N-1
      DO 10 I=1,N
   10 T(I)=0.5*XL(I)*DT/CDM(I)
      DO 50 I=2,NM1
      S(I)=PR(I)*DT/CDM(I)
      DD(I)=(-(FT +T(I)+U(I)*AA(I)))*FA
   50 DDR(I)=(-FT+T(I)+U(I)*AA(I))*FB
      IF (ABS(PL).LE.1.E-60)GO TO 60
C FLUXES ARE SPECIFIED BOTH AT TOP AND BOTTOM
      S(1)=2.0*RL(M)*DZ/PL
      DD(1) =-(FT/TT + T(1)/TT + 1.0)*FA
      DU(1)=1.0*FA
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      DDR(1) = (-FT/TT + T(1)/TT + 1.0)*FB                              017230
      F(1)=DDR(1)*DFP(1)-DU(1)*DFP(2)+S(1)                              017240
      GO TO 70                                                          017250
C FLUX AT TOP,SPECIFIED MIXING RATIO AT BOTTOM                          017260
   60 S(1)=RL(1)                                                        017270
      DD(1)=.5*FA                                                       017280
      DU(1)=0.*FA                                                       017290
      DDR(1)=-.5*FB                                                     017300
      F(1)=DDR(1)*DFP(1)+S(1)                                           017310
   70 IF (ABS(QU).LE.1.E-60)GO TO 71                                    017320
      IF (ABS(PU).LE.1.E-60)GO TO 72                                    017330
      S(N)=0.                                                           017340
      DD(N)=(1.+QU*DZ)*FA                                               017350
      DL(N)=-1.*FA                                                      017360
      DDR(N)=-DD(N)*FB                                                  017370
      GO TO 73                                                          017380
C  FLUX SPECIFIED AT TOP                                                017390
   71 S(N) = 2.0*RU*DZ/PU                                               017400
      DD(N) = 1.0*FA                                                    017410
      DL(N) = -1.0*FA                                                   017420
      DDR(N) = -1.0*FB                                                  017430
      GO TO 73                                                          017440
C  MIXING RATIO SPECIFIED AT TOP                                        017450
   72 S(N) = RU                                                         017460
      DD(N) = 0.5*FA                                                    017470
      DL(N) = 0.                                                        017480
      DDR(N) = -.5*FB                                                   017490
   73 DO 80 I=2,NM1                                                     017500
      IM1=I-1                                                           017510
      IP1=I+1                                                           017520
   80 F(I)=-DL(I)*DFP(IM1)+DDR(I)*DFP(I)-DU(I)*DFP(IP1)-S(I)            017530
      F(N)=-DL(N)*DFP(N-1)+DDR(N)*DFP(N)+S(N)                           017540
      DO 90 I=1,N                                                       017550
   90 A(I)=DD(I)                                                        017560
      DO 91 I=2,N                                                       017570
   91 B(I)=DL(I)                                                        017580
      DO 92 I=1,NM1                                                     017590
   92 C(I)=DU(I)                                                        017600
      B(1)=1.0                                                          017610
      C(N)=1.0                                                          017620
      DL(1)=1.                                                          017630
      DU(N)=1.                                                          017640
      RETURN                                                            017650
      END                                                               017660
      SUBROUTINE TRIDIA (N)                                             017670
C SUBROUTINE TRIDIA TO COMPUTE MIXING RATIO                             017680
      COMMON /COEF2/ A(81),B(81),C(81),F(81),X(81)                      017690
      REAL ALPHA(81),GAMMA(81),G(81)                                    017700
      IF (A(1).EQ.0.0) GO TO 100                                        017710
      ALPHA(1)=A(1)                                                     017720
      GAMMA(1)=C(1)/ALPHA(1)                                            017730
      NM1=N-1                                                           017740
      DO 10 I=1,NM1                                                     017750
      IF (ALPHA(I).EQ.0.0) GO TO 100                                    017760
      GAMMA(I)=C(I)/ALPHA(I)                                            017770
      IP1=I+1                                                           017780
   10 ALPHA(IP1)=A(IP1)-B(IP1)*GAMMA(I)                                 017790
      G(1)=F(1)/ALPHA(1)                                                017800
      DO 30 I=2,N                                                       017810
   30 G(I)=(F(I)-B(I)*G(I-1))/ALPHA(I)                                  017820
      X(N)=G(N)                                                         017830
      DO 40 I=1,NM1                                                     017840
      J=N-I                                                             017850
   40 X(J)=G(J)-GAMMA(J)*X(J+1)                                         017860
      GO TO 101                                                         017870
  100 WRITE (6,105) I                                                   017880
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  105 FORMAT (/,2X,*SINGULAR MATRIX - I =*,I3/)                          017890
  101 RETURN                                                             017900
      END                                                                017910
      SUBROUTINE REPCN (N1,OKPO3)                                        017920
      LOGICAL OKPO3                                                      017930
      COMMON /JVAL/ CJO2(50),CJO3(50),CJCF2(50),CJCF3(50),CJCCL4(50),    017940
     1              CJCH3C(50),CJCLO3(50),CJN2O(50),CJHNO3(50)           017950
     2, CJH2O2(50),CJO31(50),CJN2O5(50)                                  017960
      COMMON /MODEL/ALT(41),TEMP(41),DM(41),DID(41),DA23(41)             017970
      REAL JNO3                                                          017980
      COMMON /RATES/ RATE(65,81),RA(65),RB(65),JNO3,PJO3                 017990
      REAL NO,NO2,NOX,NO3,N2O5                                           018000
      COMMON /SPECIE/ H(41),OH(41),HO2(41),H2O2(41),O3(41),O(41),NO(41),018010
     1 NO2(41),HNO3(41),NOX(41),CO(41),O2(41),CH4(41),H2O(41),H2(41),    018020
     2 CL(41),CLO(41),HCL(41),CLX(41),DCLX(41),NO3(41),N2O5(41),         018030
     3 CLNO3(41)                                                         018040
      COMMON /XXES/ X1(81),X2(81),X3(81),X4(81),X5(81),X6(81),X7(81),    018050
     1 X8(81),X9(81),X10(81)                                             018060
      REAL     CLO1(41),NO21(41)                                         018070
C                                                                        018080
      N11 = (N1 - 1)/2                                                   018090
      E1MAX = 0.                                                         018100
      E2MAX = 0.                                                         018110
      DO 10 I = 1,N11                                                    018120
      L = 2*I - 1                                                        018130
      CLO1(I) = CLO(I)                                                   018140
      NO21(I) = NO2(I)                                                   018150
      ALP = (CJO3(I) + PJO3)/(RATE(34,L)*.21*DM(I)**2)                   018160
      O3(I) = X8(2*I - 1) * DM(I)                                        018170
      O(I) = ALP * O3(I)                                                 018180
      CLX(I) = X7(L)*DM(I)                                               018190
      NOX(I) = X2(L)*DM(I)                                               018200
      CALL PNOX (I)                                                      018210
      CALL PCLOX(I)                                                      018220
      E1 = ABS((CLO(I) - CLO1(I))/CLO1(I))                               018230
      IF (E1.GT.E1MAX) E1MAX = E1                                        018240
      E2 = ABS((NO2(I) - NO21(I))/NO21(I))                               018250
      IF (E2.GT.E2MAX) E2MAX = E2                                        018260
      CLO(I) = (CLO(I) + CLO1(I))/2.                                     018270
      NO2(I) = (NO2(I) + NO21(I))/2.                                     018280
   10 CONTINUE                                                           018290
      IF (E1MAX.LT..010.AND.E2MAX.LT..010) OKPO3 = .TRUE.                018300
      RETURN                                                             018310
      END                                                                018320
      SUBROUTINE O3LINT (X,Y,IL,IU)                                      018330
      DIMENSION X(9,41),Y(9)                                             018340
C                                                                        018350
      IF (IU.LE.40) GO TO 5                                              018360
      WRITE (6,600) IU                                                   018370
  600 FORMAT (1H0,* IN SUBROUTINE O3LINT, IU =*,I3,* - TOO HIGH FOR INTE018380
     1GRAND ARRAY*)                                                      018390
      STOP                                                               018400
C                                                                        018410
    5 DO 10 I =1,9                                                       018420
      Y(I) = 0.                                                          018430
      DO 10 J = IL,IU                                                    018440
   10 Y(I) = Y(I) + (X(I,J) + X(I,J+1))*1.E5                             018450
C                                                                        018460
      RETURN                                                             018470
      END                                                                018480
      SUBROUTINE PRINTX (I,LLL,LLU)                                      018490
      COMMON /INTDEN/DO3INT(41),DMINT(41),DAINT(41)                      018500
      COMMON /JVAL/ CJO2(50),CJO3(50),CJCF2(50),CJCF3(50),CJCCL4(50),    018510
     1              CJCH3C(50),CJCLO3(50),CJN2O(50),CJHNO3(50)           018520
     2, CJH2O2(50),CJO31(50),CJN2O5(50)                                  018530
      COMMON /MODEL/ALT(41),TEMP(41),DM(41),DID(41),DA23(41)             018540
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      COMMON /MOL4YD/ XH(81),XH2O(81),PH2O,RH2,X11(81)                  018550
      COMMON /NDATA/ CEK(81),CDM(81),CTEMP(81),CDA(81)                  018560
      COMMON /OLD/ OJO2(41),OJO3(41),OJCF2(41),OJCF3(41),OJCCL4(41),    018570
     1 OJCH3C(41),OJCLO3(41),OJN2O(41),OJHNO3(41),OJH2O2(41),OJO31(41), 018580
     2 OJN2O5(41),OLDOH(41),OO3INT(41),OO3(41)                          018590
      COMMON /PRODS/      POOOH(7,41),SOOOH(9,41),O3INT(41),CLCH4(41),  018600
     1 YY(9),HHH(9,41)                                                  018610
      REAL NO,NO2,NOX,NO3,N2O5                                          018620
      COMMON /SPECIE/ H(41),OH(41),HO2(41),H2O2(41),O3(41),O(41),NO(41),018630
     1 NO2(41),HNO3(41),NOX(41),CO(41),O2(41),CH4(41),H2O(41),H2(41),   018640
     2 CL(41),CLO(41),HCL(41),CLX(41),OCLX(41),NO3(41),N2O5(41),        018650
     3 CLNO3(41)                                                        018660
      DIMENSION XL11(81)                                                018670
      COMMON /TRAPH2/ XL11                                              018680
      COMMON /XLS/ XL1(81),XL2(81),XL3(81),XL4(81),XL5(81),XL6(81),     018690
     1 XL7(81),XL8(81),XL9(81),XL10(81)                                 018700
      COMMON /XXES/ X1(81),X2(81),X3(81),X4(81),X5(81),X6(81),X7(81),   018710
     1 X8(81),X9(81),X10(81)                                            018720
      DIMENSION C1(41),C4(41),C5(41),C6(41),C9(41)                      018730
      REAL MCL(41),MCLO(41),MHCL(41),MCLNO3(41),M9(41)                  018740
C                                                                       018750
      CALL PAGE                                                         018760
      WRITE (6,601) I                                                   018770
      WRITE (6,602) (ALT(J),OJO2(J),OJO3(J),OJCF2(J),OJCF3(J),OJO31(J), 018780
     1              OO3(J),OO3INT(J),OHINT(J),OLDOH(J),J=LLL,LLU)       018790
      CALL PAGE                                                         018800
      WRITE (6,603) I                                                   018810
      WRITE (6,604) (ALT(J),OJCLO3(J),OJN2O(J),OJHNO3(J),OJH2O2(J),     018820
     1 OJN2O5(J),OJCCL4(J),OJCH3C(J),J=LLL,LLU)                         018830
C                                                                       018840
      CALL PAGE                                                         018850
      WRITE (6,1601)                                                    018860
      WRITE (6,602) (ALT(J),CJO2(J),CJO3(J),CJCF2(J),CJCF3(J),CJO31(J), 018870
     1              O3(J),DO3INT(J),DHINT(J),   OH(J),J=LLL,LLU)        018880
      CALL PAGE                                                         018890
      WRITE (6,1603)                                                    018900
      WRITE (6,604) (ALT(J),CJCLO3(J),CJN2O(J),CJHNO3(J),CJH2O2(J),     018910
     1 CJN2O5(J),CJCCL4(J),CJCH3C(J),J=LLL,LLU)                         018920
C                                                                       018930
      DO 10 J = LLL,LLU                                                 018940
      MCL(J) = CL(J)/DM(J)                                              018950
      MCLO(J) = CLO(J)/DM(J)                                            018960
      MHCL(J) = HCL(J)/DM(J)                                            018970
      MCLNO3(J) = CLNO3(J)/DM(J)                                        018980
   10 CONTINUE                                                          018990
      NLINE = LLU - LLL + 1                                             019000
      CALL PAGE                                                         019010
      CALL LINES (3+NLINE),RETURNS(315)                                 019020
  315 WRITE (6,605)                                                     019030
      WRITE (6,606)(K,ALT(K),H(K),OH(K),HO2(K),H2O2(K),O(K),O3(K),      019040
     1 O3INT(K),DID(K),K=LLL,LLU)                                       019050
      CALL LINES (3+NLINE),RETURNS(320)                                 019060
  320 WRITE (6,607)                                                     019070
      WRITE (6,608)(K,ALT(K),NO(K),NO2(K),HNO3(K),NO3(K),N2O5(K),NOX(K),019080
     1 K=LLL,LLU)                                                       019090
      CALL LINES (3+NLINE),RETURNS(325)                                 019100
  325 WRITE (6,609)                                                     019110
      WRITE (6,615) (K,ALT(K),CL(K),HCL(K),CLO(K),MCLO(K),MCL(K),       019120
     1 MHCL(K),CLNO3(K),MCLNO3(K),OCLX(K),K=LLL,LLU)                    019130
C                                                                       019140
      CALL LINES (7+NLINE),RETURNS(330)                                 019150
  330 WRITE (6,614)                                                     019160
      WRITE (6,615) (K,ALT(K),(HHH(J,K),J=1,9),K=LLL,LLU)               019170
      WRITE (6,714)                                                     019180
      WRITE (6,715) (YY(J),J=1,9)                                       019190
      CALL LINES (3+NLINE),RETURNS(335)                                 019200
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  335 WRITE (6,615)                                                     019210
      WRITE (6,606) (K,ALT(K),(PODOH(J,K),J=1,7),CLCH4(K),K=LLL,LLU)    019220
      CALL LINES (3+NLINE),RETURNS(340)                                 019230
  340 WRITE (6,618)                                                     019240
      WRITE (6,615) (K,ALT(K),(SOODH(J,K),J=1,9),K=LLL,LLU)             019250
C                                                                       019260
      CALL PRINT9 (X1,X2,X3,X4,X5,X6,X7,X9,X11,4HN2O ,4HNOX ,4HCH4 ,    019270
     1 4HFC11,4HFC12,4HCH3C,4HCLX ,4HCCL4,4H H2 )                       019280
C  COMPUTE FLUX AT BOTTOM                                               019290
      CALL TRAP (XL1,FN2O,1,81)                                         019300
      CALL TRAP (XL2,FNOX,1,81)                                         019310
      CALL TRAP (XL3,FCH4,1,81)                                         019320
      CALL TRAP (XL4,FF11,1,81)                                         019330
      CALL TRAP (XL5,FF12,1,81)                                         019340
      CALL TRAP (XL6,FCH3C,1,81)                                        019350
      CALL TRAP (XL7,FCLX,1,81)                                         019360
      CALL TRAP (XL9,FCCL4,1,81)                                        019370
      CALL TRAP (XL11,FH2,1,81)                                         019380
      WRITE (6,70) FN2O,FNOX,FCH4,FF11,FF12,FCH3C,FCLX,FCCL4,FH2        019390
C                                                                       019400
      DO 100 J = LLL,LLU                                                019410
      K = 2*J - 1                                                       019420
      C4(J) = X4(K) * CDM(K)                                            019430
      C5(J) = X5(K) * CDM(K)                                            019440
      C6(J) = X6(K) * CDM(K)                                            019450
      C9(J) = X9(K) * CDM(K)                                            019460
      C1(J) = X1(K) * CDM(K)                                            019470
      M8(J) = O3(J)/DM(J)                                               019480
  100 CONTINUE                                                          019490
      CALL PAGE                                                         019500
      WRITE (6,611)                                                     019510
      WRITE (6,608) (K,ALT(K),M8(K),C4(K),C5(K),C6(K),C9(K),            019520
     1 CLX(K),K=LLL,LLU)                                                019530
      CALL PAGE                                                         019540
      WRITE (6,612)                                                     019550
      WRITE (6,613) (K,ALT(K), C1(K),HOX(K),CH4(K),K=LLL,..U)           019560
      RETURN                                                            019570
C                                                                       019580
   70 FORMAT (1H0,3X,*FN2O =*,1PE13.5,4X,*FNOX =*,E13.5,4X,             019590
     1 *FCH4 =*,E13.5,4X,*FF11 =*,E13.5,4X,*FF12 =*,E13.5//             019600
     2 4X,*FCH3C =*,E13.5,4X,*FCLX =*,E13.5,4X,*FCCL4 =*,E13.5,         019610
     3 4X,*FH2 =*,E13.5)                                                019620
  601 FORMAT (1H0,5X,*LAST ITERATION =*,I3     // 5X,*ALT*,6X,*CJO2*, 7X,019630
     1 *CJO3*, 6X,*CJCF2*, 6X,*CJCF3*,6X,*CJO31*,5X,*PREVO3*,5X,        019640
     2 *DO3INT*,5X,*DMINT*,6X,*PREVOH*//)                               019650
  602 FORMAT (1H ,0PF9.0, 1P09E11.3)                                    019660
  603 FORMAT (1H0,5X,*LAST ITERATION =*,I3     //                       019670
     A                                  6X,*ALT*,5X,*CJCLO3*,5X,*CJN2O*,019680
     1 6X,*CJHNO3*,5X,*CJH2O2*,5X,*CJN2O5*,5X,*CJCCL4*,4X,*CJCH3CL*//)  019690
  604 FORMAT (1H ,0PF9.0, 1P07E11.3)                                    019700
  605 FORMAT (1H0,2X,*K*,7X,*ALT*, 9X,*H*,12X,*OH*,12X,*HO2*,11X,*H2O2*,019710
     1 11X,*O*,13X,*O3*,10X,*O3INT*,9X,*O(**D)*/)                       019720
  606 FORMAT (1H , I3,0PF11.0,1P8E14.4)                                 019730
  607 FORMAT (1H0,2X,*K*,7X,*ALT*, 9X,*NO*,13X,*NO2*,12X,*HNO3*,11X,    019740
     1 *NO3*,12X,*N2O5*,10X,* NOX*/)                                    019750
  608 FORMAT (1H , I3,0PF11.0,1P6E15.4)                                 019760
  609 FORMAT (1H0,1X,*K*,7X,*ALT*,15X,*CL*,23X,*CLO*,23X,*HCL*,22X,     019770
     1 *CLNO3*,15X,*OCLX*/)                                             019780
  610 FORMAT (1H , I3,0PF11.0,1P5E15.4)                                 019790
  611 FORMAT (1H0,2X,*K*,7X,*ALT*,8X,*MR O3*,11X,*FC11*,11X,*FC12*,10X, 019800
     1 *CH3CL*,11X,*CCL4*,11X,*CLX*/)                                   019810
  612 FORMAT (1H0,2X,*K*,7X,*ALT*, 9X,*N2O*,12X,*HOX*,12X,*CH4*/)       019820
  613 FORMAT (1H ,I3,0PF11.0,1P3E15.4)                                  019830
  614 FORMAT (1H0,1X,*K*,7X,*ALT*,6X,*H + O3*,7X,*OH + O3*,5X,          019840
     1 *HO2 + O3*,6X,*HO2 + O*,6X,*OH + O*,7X,*NO2 + O*,6X,*CLO + O*,   019850
     2 6X,*O + O3*, 7X,*O2 + HV*/)                                      019860
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  615 FORMAT (1H ,I2,0PF11.0,1P9E13.4)                                  019870
  616 FORMAT (1H0,2X,*K*,7X,*ALT*,6X,*H2O + HV*,6X,*H2O + O1D*,5X,      019880
     1 *CH4 + O1D*,5X,*HNO3 + HV*,5X,*CO + OH*,7X,*NO + HO2*,5X,        019890
     2 *JH2O2+H2O2*,5X,*CL + CH4*/)                                     019900
  617 FORMAT (1H , I3,0PF11.0,1P7E15.4)                                 019910
  618 FORMAT (1H0,2X,*K*,7X,*ALT*,5X,*H2O2 + OH*,4X,*HO2 + OH*,5X,      019920
     1 *HCL + OH*,5X,*CH4 + OH*,5X,*OH + NO2*,5X,*OH + HNO3*,5X,        019930
     2 *OH + OH*,5X,*H + HO2*,5X,*CL + HO2*/)                           019940
  714 FORMAT (1H0,* INTEGRATED LOSS FOR OZONE*/)                        019950
  715 FORMAT (1H ,13X,1P9E13.4)                                         019960
 1601 FORMAT (1H0,5X,*LAST ITERATION  +  1*    // 5X,*ALT*,6X,*CJO2*, 7X,019970
     1 *CJO3*, 6X,*CJCF2*, 6X,*CJCF3*,6X,*CJO31*,5X,*PREVO3*,5X,        019980
     2 *DO3INT*,5X,*DMINT*,6X,*PREVOH*//)                               019990
 1603 FORMAT (1H0,5X,*LAST ITERATION  +  1*//                           020000
     A                                  6X,*ALT*,5X,*CJCLO3*,5X,*CJN2O*,020010
     1 6X,*CJHNO3*,5X,*CJH2O2*,5X,*CJN2O5*,5X,*CJCCL4*,4X,*CJCH3CL*//)  020020
C                                                                       020030
      END                                                               020040
      SUBROUTINE TRAP (XX,XXX,N1,N2)                                    020050
      DIMENSION XX(81)                                                  020060
      XXX = (XX(N1) + XX(N2))*.5                                        020070
      N1P1 = N1 + 1                                                     020080
      N2M1 = N2 - 1                                                     020090
      DO 10 I = N1P1,N2M1                                               020100
   10 XXX = XXX + XX(I)                                                 020110
      XXX = XXX*1.0E5                                                   020120
      RETURN                                                            020130
      END                                                               020140
      SUBROUTINE PRINT9 (X1,X2,X3,X4,X5,X6,X7,X8,X9,HD1,HD2,HD3,HD4,HD5,020150
     1                   HD6,HD7,HD8,HD9)                               020160
      DIMENSION X1(81),X2(81),X3(81),X4(81),X5(81),X6(81),X7(81),X8(81),020170
     1 X9(81)                                                           020180
      COMMON /MODEL/ALT(41),TEMP(41),DM(41),DID(41),DA23(41)            020190
  600 FORMAT (1H0,6X,*ALT*,2X,9(6X,A4,3X)/)                             020200
  601 FORMAT (1X,0PF11.0,1P9E13.4)                                      020210
  603 FORMAT (1H0,5X,*MIXING RATIOS:*/)                                 020220
C                                                                       020230
      CALL PAGE                                                         020240
      WRITE (6,603)                                                     020250
      WRITE (6,600) HD1,HD2,HD3,HD4,HD5,HD6,HD7,HD8,HD9                 020260
      DO 60 I = 1,41                                                    020270
   60 WRITE (6,601)  ALT(I),X1(2*I-1),X2(2*I-1),X3(2*I-1),X4(2*I-1),    020280
     1  X5(2*I-1),X6(2*I-1),X7(2*I-1),X8(2*I-1),X9(2*I-1)               020290
      RETURN                                                            020300
      END                                                               020310
      SUBROUTINE INPUT(KEYS,N,IC,IFORM,TITLE,K),RETURNS(A)              020320
C                                                                       020330
      REAL NAME                                                         020340
      INTEGER KEYS(N),TITLE(13),KEYW(5),KEY(3),BLANK                    020350
      DATA KEYW/4HPARA,4HCOMM,4HCOMP,4HENDJ,4H9999/,BLANK/1H /,         020360
     X NAME/5HINPJT/                                                    020370
C                                                                       020380
   10 READ(5,5010)KEY,IC,IFORM,TITLE,JF                                 020390
 5010 FORMAT(3A4,I3,I3,2X,12A4,2A2)                                     020400
      IF(EOF(5))800,15                                                  020410
   15 IF(IC)20,49,22                                                    020420
   20 IC=-IC                                                            020430
      REWIND IC                                                         020440
   22 CALL PAGE                                                         020450
      CALL LINES(4),RETURNS(25)                                         020460
   25 WRITE(6,6025)IC,TITLE                                             020470
 6025 FORMAT(/T21,*TAPE*,I2,T31,*LABEL=*,12A4,A2//)                     020480
      IF(JF.NE.BLANK)CALL INE(IC,.TRUE.)                                020490
      READ(IC,5010)KEY,K,IFORM,TITLE,JF                                 020500
      IF(EOF(IC))800,50                                                 020510
   49 IC=5                                                              020520
```

```
   50 DO 60 K=1,5                                                    020530
      IF(KEY(1).EQ.KEYW(K))GO TO (100,200,10,400,10),K               020540
   60 CONTINUE                                                       020550
      DO 80 K=1,N                                                    020560
      IF(KEY(1).EQ.KEYS(K))GO TO 90                                  020570
   80 CONTINUE                                                       020580
      CALL ERRX(80,NAME)                                             020590
   90 IF(IC.EQ.5)CALL PAGE                                           020600
      WRITE(6,6090)KEY,TITLE,IC                                      020610
 6090 FORMAT(/T2,3A4,T21,12A4,A2,T81,*(UNIT *,I2,*)*/)               020620
      CALL LINES(3),RETURNS(95)                                      020630
   95 RETURN                                                         020640
  100 CALL INPARM                                                    020650
      GO TO 10                                                       020660
  200 CALL INE(IC,.TRUE.)                                            020670
      GO TO 10                                                       020680
  800 CALL ERRM(800,NAME),RETURNS(400)                               020690
  400 RETURN A                                                       020700
      END                                                            020710
      SUBROUTINE PAGE                                                020720
C     ***************************************************************020730
C     PRINTS PAGE HEADER AND KEEPS TRACK OF LINE COUNT               020740
C     VERSION 1.0  LEVEL 711122                                      020750
C     ***************************************************************020760
      INTEGER ICODE,IRUN,NPAGE                                       020770
      REAL TITLE(6)                                                  020780
      COMMON /HEAD/ TITLE,ICODE,VERS,LEVEL,DAT, IRUN,NPAGE,NLOG      020790
      COMMON/LINUM/LINE                                              020800
C     ---------------------------------------------------------------020810
      LINE=4                                                         020820
      NPAGE=NPAGE+1                                                  020830
      WRITE (6,2030) ICODE,IRUN,TITLE,VERS,LEVEL,DAT, NPAGE          020840
 2030 FORMAT(*1*,I3,I6,5X,6A8,* VERSION *,F5.1,*  (*,I6,*)*,11X,     020850
     X   A10,10X,*PAGE *,I3/1X,127(*-*))                            020860
      RETURN                                                         020870
      END                                                            020880
      SUBROUTINE LINES(N),RETURNS(A)                                 020890
C     ***************************************************************020900
C     VERSION 1.0   LEVEL 760921                                     020910
C     ***************************************************************020920
      REAL TITLE(6)                                                  020930
      INTEGER ICODE,IRUN,NPAGE,LCT                                   020940
      COMMON /HEAD/ TITLE,ICODE,VERS,LEVEL,DATE,IRUN,NPAGE,NLOG      020950
      COMMON/LINUM/LINE                                              020960
      DATA LCT/61/                                                   020970
C     ---------------------------------------------------------------020980
      LINE=LINE+N                                                    020990
      IF(LINE.LT.LCT) RETURN                                         021000
      LINE=N+4                                                       021010
   30 NPAGE=NPAGE+1                                                  021020
      WRITE(6,2030) ICODE,IRUN,TITLE,VERS,LEVEL,DATE,NPAGE           021030
 2030 FORMAT(*1*,I3,I6,5X,6A8,* VERSION *,F5.1,*  (*,I6,*)*,11X,     021040
     X   A10,10X,*PAGE *,I3/1X,127(*-*))                            021050
      RETURN A                                                       021060
      END                                                            021070
      SUBROUTINE INE(IC,PRINT)                                       021080
C     ***************************************************************021090
C     VERSION 1        LEVEL 720602                                  021100
C     READS AND PRINTS COMMENTS CARDS                                021110
C     ***************************************************************021120
      REAL NAME                                                      021130
      LOGICAL PRINT                                                  021140
      INTEGER IFORM,IF(3),COM(13),BLANK                              021150
      DATA IF/1H ,1H0,1H1/,NAME/3HINE/,BLANK/1H /                    021160
C     ---------------------------------------------------------------021170
   10 READ(IC,5010)   IFORM,COM,JF                                   021180
```

```
 5010 FORMAT(14X,A1,5X,12A4,A2,A2)                                      021190
      IF(.NOT.PRINT)    GO TO 50                                        021200
      DO 20    I=1,3                                                  021210
      IF(IFORM.EQ.IF(I))    GO TO (30,30,48),I                        021220
   20 CONTINUE                                                        021230
      CALL ERRX(20,NAME)                                              021240
   30 CALL LINES(I),RETURNS(32)                                       021250
   32 WRITE(6,6032)    IF(I),COM                                      021260
 6032 FORMAT(A1,T21,12A4,A2)                                          021270
      GO TO 50                                                        021280
   40 CALL PAGE                                                       021290
      I=2                                                             021300
      GO TO 30                                                        021310
   50 IF(JF.NE.BLANK)    GO TO 10                                     021320
      RETURN                                                          021330
      END                                                             021340
      SUBROUTINE DAY                                                  021350
C     ****************************************************************021360
C     VERSION 1.0    LEVEL 760921                                     021370
C     ****************************************************************021380
      REAL TITLE(5)                                                   021390
      COMMON /HEAD/ TITLE,ICODE,VERS,LEVEL,DAT,IRUN,NPAGE,NLOG        021400
C     ----------------------------------------------------------------021410
      DAT = DATE()                                                    021420
      RETURN                                                          021430
      END                                                             021440
      SUBROUTINE ERRX(N,NAME)                                         021450
C     ****************************************************************021460
C     VERSION 2     LEVEL 720421                                      021470
C     ****************************************************************021480
      INTEGER N                                                       021490
      REAL NAME                                                       021500
C     ----------------------------------------------------------------021510
      WRITE(6,6000) N,NAME                                            021520
 6000 FORMAT(*0EXECUTION TERMINATED DUE TO ERROR NO. *,I4,* IN *,A8)  021530
      STOP                                                            021540
      END                                                             021550
      SUBROUTINE ERRM(N,NAME)                                         021560
C     ****************************************************************021570
C     VERSION 1.0    LEVEL 760921                                     021590
C     ****************************************************************021590
      INTEGER N                                                       021600
      REAL NAME                                                       021610
C     ----------------------------------------------------------------021620
      WRITE(6,6100)    N,NAME                                         021630
 6100 FORMAT(*0ERROR NO. *,I4,* IN *,A8/)                             021640
      RETURN                                                          021650
      END                                                             021660
      SUBROUTINE RSCATT                                               021670
C.....................................................................021680
C                                                                     021690
C       CHLORINE MODEL STUDY PROGRAM                                  021700
C                                                                     021710
C                                                                     021720
C       SUBROUTINE RSCATT COMPUTES AEROSOL AND MOLECULAR EXTINCTION   021730
C       COEFFICIENTS                                                  021740
C       RRAY(J)= RAYLEIGH SCATTERING COEFFICIENT                      021750
C       QAE(J)= AEROSOL EXTINCTION COEFFICIENT                        021760
C       QAA(J)= AEROSOL ABSORBTION COEFFICINT                         021770
C                                                                     021780
C       SIZE DISTRIBUTION PARAMETER ISIZE= 1 (RURAL) FROM SELBY ET AL 021790
C                                          2 (MARITIME)       (1976)  021800
C                                          3 (URBAN)                  021810
C                                          4 (TROPOSPHERE)            021820
C                                          5 (SPECIAL)                021830
C       TO INPUT SPECIAL MODEL DIMENSION ALAM(8) AND QE(5),QA(5)      021840
```

```
C       N= # OF WAVELENGTH INTERVALS AEROSOL DATA DIGITIZED                021850
C       ALAM= ARRAY OF WAVELENGTH VALUES CORRESPONDING TO DIGITIZATION    021860
C.....                                                                    021870
      COMMON /SCAPAR/QRAY(100),QAE(100),QAA(100)                          021880
      COMMON /SOLCON/WL(100),FL(100),Q02(100),Q03(100)                    021890
      COMMON /PARM/ ISWIT,TSTEP,TSTOP,TLOOP,ITPRNT,ISIZE,ISCATT           021900
      DIMENSION ALAM(8),QE(5,8),QA(5,5)                                   021910
      DATA ALAM/.200,.250,.300,.400,.488,.550,.694,.860/                  021920
      DATA  IL,IU,N/1,99,7/                                               021930
C                                                                         021940
C       SPECIFY AEROSOL MODEL                                             021950
      GO TO (1,2,3,4,5)ISIZE                                              021960
C       RURAL                                                             021970
1     QE(1,1)=.38223                                                      021980
      QE(1,2)=.32979                                                      021990
      QE(1,3)=.28540                                                      022000
      QE(1,4)=.22026                                                      022010
      QE(1,5)=.17989                                                      022020
      QE(1,6)=.15800                                                      022030
      QE(1,7)=.12064                                                      022040
      QE(1,8)=.09151                                                      022050
      QA(1,1)=.07945                                                      022060
      QA(1,2)=.03661                                                      022070
      QA(1,3)=.02110                                                      022080
      QA(1,4)=.01317                                                      022090
      QA(1,5)=.01114                                                      022100
      QA(1,6)=.01095                                                      022110
      QA(1,7)=.00968                                                      022120
      QA(1,8)=.01058                                                      022130
      GO TO 20                                                            022140
C       MARITIME                                                          022150
2     QE(2,1)=.20932                                                      022160
      QE(2,2)=.19518                                                      022170
      QE(2,3)=.18479                                                      022180
      QE(2,4)=.17032                                                      022190
      QE(2,5)=.16213                                                      022200
      QE(2,6)=.15900                                                      022210
      QE(2,7)=.15001                                                      022220
      QE(2,8)=.14412                                                      022230
      QA(2,1)=.02054                                                      022240
      QA(2,2)=.00864                                                      022250
      QA(2,3)=.00442                                                      022260
      QA(2,4)=.00243                                                      022270
      QA(2,5)=.00193                                                      022280
      QA(2,6)=.00186                                                      022290
      QA(2,7)=.00155                                                      022300
      QA(2,8)=.00171                                                      022310
      GO TO 20                                                            022320
C       URBAN                                                             022330
3     QE(3,1)=.31030                                                      022340
      QE(3,2)=.28416                                                      022350
      QE(3,3)=.25805                                                      022360
      QE(3,4)=.20867                                                      022370
      QE(3,5)=.17631                                                      022380
      QE(3,6)=.15900                                                      022390
      QE(3,7)=.12601                                                      022400
      QE(3,8)=.10071                                                      022410
      QA(3,1)=.10692                                                      022420
      QA(3,2)=.08649                                                      022430
      QA(3,3)=.07571                                                      022440
      QA(3,4)=.06376                                                      022450
      QA(3,5)=.05674                                                      022460
      QA(3,6)=.05282                                                      022470
      QA(3,7)=.04528                                                      022480
      QA(3,8)=.04022                                                      022490
      GO TO 20                                                            022500
```

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C       PROPOSHERE                                                      022510
4       QE(4,1)=.40212                                                  022520
        QE(4,2)=.34505                                                  022530
        QE(4,3)=.29674                                                  022540
        QE(4,4)=.22585                                                  022550
        QE(4,5)=.18187                                                  022560
        QE(4,6)=.15800                                                  022570
        QE(4,7)=.11722                                                  022580
        QE(4,8)=.08537                                                  022590
        QA(4,1)=.08042                                                  022600
        QA(4,2)=.03451                                                  022610
        QA(4,3)=.01767                                                  022620
        QA(4,4)=.00371                                                  022630
        QA(4,5)=.00772                                                  022640
        QA(4,6)=.00745                                                  022650
        QA(4,7)=.00619                                                  022660
        QA(4,8)=.00683                                                  022670
        GO TO 20                                                        022680
5       CONTINUE                                                        022690
C         INPUT SPECIAL MODEL                                           022700
20      DO 40 J=IL,IU                                                   022710
        WLM1C=WL(J)/1.0E4                                               022720
        QRAY(J)=(9.507E-20)*(1.0E4/WLM1C)**4.0117                       022730
        QRAY(J)=QRAY(J)*1.E-5                                           022740
        IF(WLM1C.LT.0.2)GO TO 35                                        022750
        DO 30 K=1,N                                                     022760
        KP1=K+1                                                         022770
        IF(WLM1C.GE.ALAM(K).AND.WLM1C.LE.ALAM(KP1))GO TO 31             022780
30      CONTINUE                                                        022790
31      XD=WLM1C-ALAM(K)                                                022800
        QAE(J)=(QE(ISIZE,KP1)-QE(ISIZE,K))*XD/(ALAM(KP1)-ALAM(K))+      022810
     1  QE(ISIZE,K)                                                     022820
        QAE(J)=QAE(J)*1.E-5                                             022830
        QAA(J)=(QA(ISIZE,KP1)-QA(ISIZE,K))*XD/(ALAM(KP1)-ALAM(K))+      022840
     1  QA(ISIZE,K)                                                     022850
        QAA(J)=QAA(J)*1.E-5                                             022860
        GO TO 40                                                        022870
35      QAE(J)=0.0                                                      022880
        QAA(J)=0.0                                                      022890
40      CONTINUE                                                        022900
        WRITE(6,101)ISIZE                                               022910
101     FORMAT(* AEROSOL MODEL =*,I4)                                   022920
        WRITE(6,105)                                                    022930
105     FORMAT(3X,*J*,11X,*WL(J)*,8X,*QRAY(J)*,9X,*QAE(J)*,9X,*QAA(J)*) 022940
        DO 50 J=IL,IU                                                   022950
        WRITE(6,102)J,WL(J),QRAY(J),QAE(J),QAA(J)                       022960
102     FORMAT(I4,4E15.4)                                               022970
50      CONTINUE                                                        022980
        RETURN                                                          022990
        END                                                             023000
        SUBROUTINE OMEGA(NT,IL,IU,GMU)                                  023010
C.....                                                                  023020
C       SUBROUTINE OMEGA COMPUTES SINGLE SCATTERING ALBEDO PROFILE AND  023030
C       OPTICAL DEPTH AS A FUNCTION OF ALTITUDE                         023040
C       SINGLE SCATTERING ALBEDO PROFILE AS A FUNCTION OF TAU COMPUTED  023050
C       FOR INPUT TO VIM                                                023060
C                                                                       023070
C       MEAN INTENSITY RETURNED AS A FUNCTION OF TAU REINTERPOLATED     023080
C       FOR ALTITUDE LEVELS                                             023090
C                                                                       023100
C       RETURN TO COMPJ                                                 023110
C.....                                                                  023120
        COMMON /SCAPAR/QRAY(100),QAE(100),QAA(100)                      023130
        COMMON /SOLCON/WL(100),FL(100),QO2(100),QO3(100)                023140
        COMMON /INTDEN/DO3INT(41),DMINT(41),DAINT(41)                   023150
        COMMON /MODEL/ALT(41).TEMP(41).DM(41).DID(41).DA23(41)          023160
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```
      COMMON /SPECIE/H(41),OH(41),HO2(41),H2O2(41),O3(41),O(41),NO(41),    023170
     1 NO2(41),HNO3(41),NOX(41),CO(41),O2(41),CH4(41),H2O(41),H2(41),      023180
     2 CL(41),CLO(41),HCL(41),CLX(41),OCLX(41),NO3(41),N2O5(41),           023190
     3 CLNO3(41)                                                           023200
      COMMON /VRP/TAUZ(41,100),OMEGAZ(41,100),TAU(41),OMEGAT(41)           023210
      COMMON/SCA/TAUINT(100),F(41,100),FAV(41,100),FLUX(41)                023220
      COMMON /PARA/ U0,N,N1,N2,NN,NNP1,REF                                 023230
      DIMENSION IN(100),INN(100),II(41)                                    023240
C                                                                          023250
C     COMPUTE OPTICAL DEPTH AND ALBEDO AS A FUNCTION OF                    023260
C     WAVELENGTH FOR EACH LEVEL                                            023270
      PO2=0.21                                                             023280
      U0=GMU                                                               023290
      DO 20 I=1,NT                                                         023300
      DO 10 J=IL,IU                                                        023310
      TAUZ(I,J)=QO3(J)*DO3INT(I)+QO2(J)*PO2*DMINT(I)+QRAY(J)*DMINT(I)      023320
     1 /DM(1)+QAE(J)*DAINT(I)/DA23(1)                                      023330
      GAMSCA=QRAY(J)*DM(I)/DM(1)+(QAE(J)-QAA(J))*DA23(I)/DA23(1)           023340
      GAMEXT=QAE(J)*DA23(I)/DA23(1)+QRAY(J)*DM(I)/DM(1)+QO3(J)*            023350
     1 O3(I)+QO2(J)*PO2*DM(I)                                              023360
      OMEGAZ(I,J)=GAMSCA/GAMEXT                                            023370
      IF(I.NE.NT)GO TO 10                                                  023380
      TZ=TAUZ(1,J)                                                         023390
      N=TZ/.5+1.6                                                          023400
      IF(N.LT.3)N=3                                                        023410
      IF(N.GT.21)N=21                                                      023420
      IN(J)=N                                                              023430
      NN=(N-1)*2                                                           023440
      IF(TZ.LE.1.)NN=10                                                    023450
      IF(TZ.GT.1..AND.TZ.LE.3.)NN=(N-1)*5                                  023460
      IF(TZ.GT.3..AND.TZ.LE.5.)NN=(N-1)*3                                  023470
      INN(J)=NN                                                            023480
      TAUINT(J)=TZ/NN                                                      023490
10    CONTINUE                                                             023500
20    CONTINUE                                                             023510
C     COMPUTE SINGLE SCATTERING ALBEDO VS TAU AT EQUAL TAU INTERVALS       023520
      DO 50 J=IL,IU                                                        023530
      NN=INN(J)                                                            023540
      NNP1=NN+1                                                            023550
      II(1)=1                                                              023560
      II(NNP1)=NT                                                          023570
      TAU(1)=TAUZ(1,J)                                                     023580
      TAU(NNP1)=0.0                                                        023590
      OMEGAT(1)=OMEGAZ(1,J)                                                023600
      OMEGAT(NNP1)=OMEGAZ(NT,J)                                            023610
      DO 40 K=2,NN                                                         023620
      KK=NNP1-K                                                            023630
      TAU(K)=TAUINT(J)*KK                                                  023640
      DO 30 I=1,NT                                                         023650
      IM1=I-1                                                              023660
      DELTAU=TAU(K)-TAUZ(I,J)                                              023670
      IF(DELTAU)30,35,35                                                   023680
30    CONTINUE                                                             023690
      GO TO 40                                                             023700
35    OMEGAT(K  )=(OMEGAZ(IM1,J)-OMEGAZ(I,J))*DELTAU/(TAUZ(IM1,J)          023710
     1 -TAUZ(I,J))+OMEGAZ(I,J)                                             023720
      II(K)=I                                                              023730
40    CONTINUE                                                             023740
      NN=INN(J)                                                            023750
      NNP1=NN+1                                                            023760
      N=IN(J)                                                              023770
      N1=N-1                                                               023780
      N2=N-2                                                               023790
      DO 85 I=1,NT                                                         023800
      IF(OMEGAZ(I,J).GT..05)GO TO 88                                       023810
85    CONTINUE                                                             023820
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      DO 86 I=1,NT                                                      023830
      FR=0.                                                             023840
      IF(-TAUZ(1,J)/GMU.LT.-70.)GO TO 87                                023850
      FR=GMU*2.*REF*E2(TAUZ(1,J)-TAUZ(I,J))*EXP(-TAUZ(1,J)/GMU)         023860
87    F(I,J)=FR                                                         023870
      IF(-TAUZ(I,J)/GMU.LT.-70.)GO TO 86                                023880
      F(I,J)=EXP(-TAUZ(I,J)/GMU)+FR                                     023890
86    CONTINUE                                                          023900
      GO TO 50                                                          023910
88    CALL VIM                                                          023920
C     CONVERT FLUX FROM TAU TO Z LEVELS FOR COMPJ                       023930
      F(1,J)=FLUX(1)                                                    023940
      F(NT,J)=FLUX(NNP1)                                                023950
      DO 70 K=2,NN                                                      023960
      IKL=II(K)                                                         023970
      IKU=II(K+1)                                                       023980
      IF(IKL.EQ.IKU)GO TO 70                                            023990
      IKU=IKU-1                                                         024000
      DO 60 I=IKL,IKU                                                   024010
      KP1=K+1                                                           024020
      TAUEXP=TAU(K)-TAUZ(I,J)                                           024030
      TAUEXP=TAUEXP/TAUINT(J)                                           024040
      F(I,J)=(FLUX(KP1)**TAUEXP)*(FLUX(K)**(1.-TAUEXP))                 024050
60    CONTINUE                                                          024060
70    CONTINUE                                                          024070
50    CONTINUE                                                          024080
      RETURN                                                            024090
      END                                                               024100
      SUBROUTINE VIM                                                    024110
C.....024120
C     VARIATIONAL ITERATIVE METHOD CALCULATES ATMOSPHERIC MULTIPLE      024130
C     SCATTERING AND SURFACE REFLECTION EFFECTS WHICH AFFECT PHOTO-     024140
C     DISSOCIATION RATES                                                024150
C                                                                       024160
C     INPUT INFORMATION INCLUDES SURFACE REFLECTION COEFFICIENT,         024170
C     SINGLE SCATTERING ALBEDO AND OPTICAL DEPTH PROFILES               024180
C     RESULTANT FLUX ADJUSTMENT PROFILE RETURNS TO OMEGA                024190
C                                                                       024200
C     ADAPTED FROM A. K. BURKE, E.R.T., INC. 1977                       024210
C.....024220
      LOGICAL LINEQN                                                    024230
      REAL M,MIN,INT                                                    024240
      COMMON /PARA/U0,N,N1,N2,NN,NNP1,REF                               024250
      COMMON/SCA/TAUINT(100),Q(41,100),FAV(41,100),FLUX(41)             024260
      COMMON /VRP/TAUZ(41,100),OMEGAZ(41,100),TAU(41),OMEGAT(41)        024270
      COMMON /MATRIX/M(20,21)                                           024280
      COMMON /MESH/ T(21),G(101),W(21)                                  024290
      COMMON /EFUN/ E3T(21),E2T(101),E3TT(101),E3T1(101),E2TT(101)      024300
      COMMON /COEFF/ A(20),AA(20)                                       024310
      DIMENSION S1(101),T1(101),S0(101)                                 024320
      DIMENSION SS2(101),F(101),F0(101),F1(101),F2(101)                 024330
      DIMENSION GG(101),FF(21),WW(101)                                  024340
      DIMENSION U(50),INT(50),GA(101)                                   024350
      DIMENSION E3(101),EX(101)                                         024360
    4 FORMAT(/*1*,6X,*MATRIX ELEMENTS, WL=*,I4)                         024370
    5 FORMAT(    4X,1P11E11.3)                                          024380
    6 FORMAT(//,9X,*TA*,8X,*A(J)*,10X,*AA(J)*)                          024390
    7 FORMAT(    6X,E9.3,2E16.6)                                        024400
    9 FORMAT(  * SINGULAR MATRIX*)                                      024410
   11 FORMAT(*1*,3X,*T1*,9X,*1ST ITERATION*,5X,*OMEGA*)                 024420
   12 FORMAT(    6X,E9.3,5X,E14.6,5X,E14.6)                            024430
   13 FORMAT(///,6X,*ITERATION= *,I5,/,9X,*T1*,9X,*NEW ITERA*,3X,*LAST  024440
     1ITERA*,9X,*DEL*)                                                  024450
   14 FORMAT(    6X,E9.3,3(5X,E14.6))                                  024460
   16 FORMAT(//,5X,*NOT CONVERGE*)                                      024470
   17 FORMAT(4X,F7.3,5(5X,E14.6))                                       024480
```

```
   18 FORMAT(///,7X,*T*,10X,*F*,19X,*=0*,16X,*F1*,18X,*F2*,18X,*F3*)      024490
C                                                                        024500
C     DEFINE T1 AND WW SUCH THAT K=1 CORRESPONDS TO TOP OF ATMOSPHERE,   024510
C     K=NNP1 IS BOTTOM OF ATMOSPHERE                                     024520
C                                                                        024530
      DO 111 K=1,NNP1                                                    024540
      NK=NNP1-K+1                                                        024550
      T1(K)=TAU(NK)                                                      024560
  111 WW(K)=OMEGAT(NK)                                                   024570
      DO 45 K=1,NNP1                                                     024580
      E2T(K)=E2(T1(K))                                                   024590
      E3T1(K)=E3(T1(K))                                                  024600
      E2TT(K)=E2(T1(NNP1)-T1(K))                                         024610
      E3TT(K)=E3(T1(NNP1)-T1(K))                                         024620
      EX(K)=EXP(-T1(K)/U0)                                               024630
   45 CONTINUE                                                           024640
      DT=T1(NNP1)/N1                                                     024650
      K=0                                                                024660
      L=NN/N1+.1                                                         024670
C                                                                        024680
C     COMPUTE T AND W PROFILES                                           024690
C                                                                        024700
      T(N)=DT*N1                                                         024710
      E3T(N)=E3(T(N))                                                    024720
      DO 10 J=1,N1                                                       024730
      T(J)=DT*(J-1)                                                      024740
      E3T(J)=E3(T(J))                                                    024750
      SUM=0.                                                             024760
      DO 15 KK=1,L                                                       024770
      K=K+1                                                              024780
      SUM=SUM+WW(K)                                                      024790
   15  W(J)=SUM/L                                                        024800
   10  CONTINUE                                                          024810
      DO 46 K=1,NNP1                                                     024820
      S0(K)=.5*WW(K)*(E2TT(K)*U0*REF+.5)*EX(K)                           024830
   46 CONTINUE                                                           024840
      CALL RMATRI                                                        024850
      DO 20 J=1,N1                                                       024860
      FF(J)=M(J,N)                                                       024870
   20 CONTINUE                                                           024880
      IF (LINEQN(N-1)) GO TO 100                                         024890
      DO 25 J=1,N1                                                       024900
      TA   =(T(J)+T(J+1))*0.5                                            024910
C                                                                        024920
C THIS IS T AVERAGE FOR EACH LAYER                                       024930
C                                                                        024940
      A(J)=M(J,N)                                                        024950
C                                                                        024960
C THIS IS SOLUTION TO MATRIX EQN                                         024970
C                                                                        024980
      AA(J)=SQRT(W(J))*A(J)                                              024990
C                                                                        025000
C THIS IS AVERAGE SOURCE IN THE INTERVAL                                 025010
C                                                                        025020
   25 CONTINUE                                                           025030
      GO TO 200                                                          025040
  100 WRITE(6,9)                                                         025050
      GO TO 400                                                          025060
  200 S2=0.                                                              025070
      DO 40 J=1,N1                                                       025080
      JP1=J+1                                                            025090
      SS2(J)=AA(J)*(E3(T(N)-T(JP1))-E3(T(N)-T(J)))                       025100
      S2=S2+SS2(J)                                                       025110
   40 CONTINUE                                                           025120
      DO 30 K=1,NNP1                                                     025130
      K=T1(K)                                                            025140
```

AD-A053 284 ENVIRONMENTAL RESEARCH AND TECHNOLOGY INC CONCORD MASS F/G 4/1
DEVELOPMENT OF THE RADIATIVE TRANSFER PORTION OF A 1-D PHOTOCHE--ETC(U)
MAR 78 R G ISAACS, H K BURKE, N TRIPP F19628-77-C-0078
UNCLASSIFIED ERT-P-2994F AFGL-TR-77-0293 NL

2 OF 2
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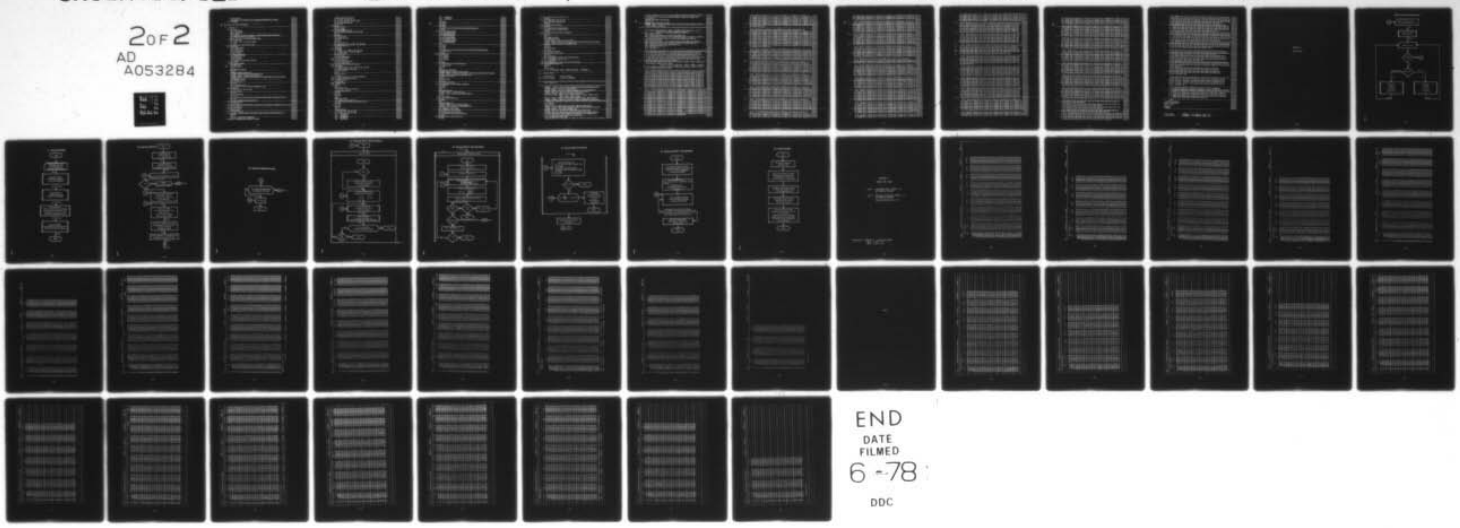
A053284



END
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      S1(K)=S11(X)                                                      025150
      G(K)=S0(K)+.5*WW(K)*S1(K)+.5*WW(K)*REF*E2TT(K)*S2*2.              025160
   30 CONTINUE                                                          025170
C                                                                       025180
C  RESULT OF 1ST ITERATION                                              025190
C                                                                       025200
      II=2                                                              025210
  300 DIFF=0.                                                           025220
      CALL COMP(SG)                                                     025230
      DO 35 K=1,NNP1                                                    025240
      GG(K)=G(K)                                                        025250
      G(K)=S0(K)+.5*WW(K)*S1NT(K)+.5*WW(K)*REF*E2TT(K)*SG*2.            025260
      DEL=ABS((GG(K)-G(K))/G(K))                                        025270
C     WRITE (6,14) T1(K),G(K),GG(K),DEL                                 025280
   35 DIFF=DIFF+DEL                                                     025290
      IF (DIFF .LE. .1) GO TO 400                                       025300
      II=II+1.                                                          025310
      IF (II .LT. 10.) GO TO 300                                        025320
  400 CONTINUE                                                          025330
      Y=EXP(-T(N)/U0)                                                   025340
      CALL COMP(SG)                                                     025350
      DO 50 K=1,NNP1                                                    025360
      F0(K)=EX(K)                                                       025370
      F1(K)=2.*S1NT(K)                                                  025380
      X=2.*REF*E2TT(K)                                                  025390
      F2(K)=X*SG*2.                                                     025400
      F3(K)=X*U0*Y                                                      025410
      F(K)=F0(K)+F1(K)+F2(K)+F3(K)                                      025420
   50 CONTINUE                                                          025430
      DO 333 K=1,NNP1                                                   025440
      NK=NNP1-K+1                                                       025450
  333 FLUX(K)=F(NK)                                                     025460
      END                                                               025470
      SUBROUTINE RMATRI                                                 025480
      REAL M                                                            025490
      COMMON /MATRIX/M(20,21)                                           025500
      COMMON /PARA/U0,N,N1,N2,NN,NNP1,REF                               025510
      COMMON /MESH/ T(21),G(101),W(21)                                  025520
      COMMON /EFUN/ E3T(21),E2T(101),E3TT(101),E3T1(101),E2TT(101)      025530
      DIMENSION DH(21)                                                  025540
      DIMENSION TJ(21)                                                  025550
      DO 10 J=1,N1                                                      025560
      JP1=J+1                                                           025570
      DH(J)=T(JP1)-T(J)                                                 025580
      M(J,J)=DH(J)-W(J)*(DH(J)+E3(DH(J))-.5)                            025590
   10 CONTINUE                                                          025600
      IF (N .EQ. 3) GO TO 100                                           025610
      DO 20 I=1,N2                                                      025620
      IP1=I+1                                                           025630
      DO 20 J=IP1,N1                                                    025640
      JP1=J+1                                                           025650
      EE=  E3(T(J)-T(I))-E3(T(J)-T(IP1))-E3(T(JP1)-T(I))+E3(T(JP1)-     025660
     1T(IP1))                                                           025670
      M(I,J)=.5*SQRT(W(I)*W(J))*EE                                      025680
   20 M(J,I)=M(I,J)                                                     025690
      GO TO 200                                                         025700
  100 M(1,2)=.5*SQRT(W(1)*W(2))*(E3(DH(1))+E3(DH(2))-E3(DH(1)+DH(2))-.5)025710
      M(2,1)=M(1,2)                                                     025720
  200 DO 30 J=1,N1                                                      025730
      TU(J)=T(J)                                                        025740
      TU(J+1)=T(J+1)                                                    025750
   30 M(J,N)= .25*U0*(EXP(-TU(J)/U0)-EXP(-TU(J+1)/U0))*(W(J))**.5       025760
      RETURN                                                            025770
      END                                                               025780
      LOGICAL FUNCTION LINEQN(N)                                        025790
C GAUSSIAN ELIMINATION METHOD IS USED                                   025800
```

```
      COMMON/MATRIX/A(20,21)                                          025810
      IF (N .GT. 1) GO TO 10                                          025820
      IF (A(1,1).EQ.0.) GO TO 500                                     025830
      A(1,2)=A(1,2)/A(1,1)                                            025840
      GO TO 420                                                       025850
   10 SUM=0.                                                          025860
      DO 20 I=1,N                                                     025870
      DO 20 J=1,N                                                     025880
   20 SUM=SUM+ABS(A(I,J))                                             025890
      TOLER=(SUM/FLOAT(N)**2)*1.E-10                                  025900
      N1=N-1                                                          025910
      NP1=N+1                                                         025920
      DO 300 K=1,N1                                                   025930
      TEMP=ABS(A(K,K))                                                025940
      ITEMP=K                                                         025950
      KP1=K+1                                                         025960
      DO 100 I=KP1,N                                                  025970
      IF(ABS(A(I,K)).LE.TEMP) GO TO 100                               025980
      TEMP=ABS(A(I,K))                                                025990
      ITEMP=I                                                         026000
  100 CONTINUE                                                        026010
      IF (TEMP .LE. TOLER) GO TO 500                                  026020
      IF (ITEMP .EQ. K) GO TO 200                                     026030
      DO 110 I=K,NP1                                                  026040
      TEMP=A(K,I)                                                     026050
      A(K,I)=A(ITEMP,I)                                               026060
  110 A(ITEMP,I)=TEMP                                                 026070
  200 DO 210 I=KP1,N                                                  026080
      A(I,K)=A(I,K)/A(K,K)                                            026090
      DO 210 J=KP1,NP1                                                026100
  210 A(I,J)=A(I,J)-A(I,K)*A(K,J)                                     026110
  300 CONTINUE                                                        026120
      IF (ABS(A(N,N)) .LE. TOLER) GO TO 500                           026130
      A(N,NP1)=A(N,NP1)/A(N,N)                                        026140
      DO 410 I=1,N1                                                   026150
      K=N-I                                                           026160
      DO 400 J=1,I                                                    026170
      L=NP1-J                                                         026180
  400 A(K,NP1)=A(K,NP1)-A(K,L)*A(L,NP1)                               026190
  410 A(K,NP1)=A(K,NP1)/A(K,K)                                        026200
  420 LINEQN=.FALSE.                                                  026210
      GO TO 600                                                       026220
  500 LINEQN=.TRUE.                                                   026230
  600 RETURN                                                          026240
      END                                                             026250
      FUNCTION E2(X)                                                  026260
      IF (X .LE. 1.0E-6) GO TO 1                                      026270
      E2=EXP(-X)-X*E(X)                                               026280
      RETURN                                                          026290
    1 E2=1.0                                                          026300
      RETURN                                                          026310
      END                                                             026320
      FUNCTION E3(X)                                                  026330
      IF (X.LE.1.0E-6) GO TO 1                                        026340
      E3=(EXP(-X)-X*(EXP(-X)-X*E(X)))*0.5                             026350
      RETURN                                                          026360
    1 E3= .5                                                          026370
      RETURN                                                          026380
      END                                                             026390
      FUNCTION E(X)                                                   026400
      IF (X.GE.10.) GO TO 200                                         026410
      IF (X.GE.1.0) GO TO 100                                         026420
      A0=- .57721566                                                  026430
      A1=  .99999193                                                  026440
      A2=- .24991055                                                  026450
      A3=  .05519968                                                  026460
```

```
      A4=- .00976004                                                    026470
      A5=  .00107857                                                    026480
      X1=X                                                              026490
      X2=X*X1                                                           026500
      X3=X*X2                                                           026510
      X4=X*X3                                                           026520
      X5=X*X4                                                           026530
      E=A0+A1*X1+A2*X2+A3*X3+A4*X4+A5*X5-ALOG(X)                        026540
      RETURN                                                            026550
  100 A1=8.573328740100                                                 026560
      A2=18.059016973000                                                026570
      A3=8.634760892500                                                 026580
      A4= .267773734300                                                 026590
      B1=9.573322345400                                                 026600
      B2=25.632956148600                                                026610
      B3=21.099650382700                                                026620
      B4=3.958496922800                                                 026630
      X1=X                                                              026640
      X2=X*X1                                                           026650
      X3=X*X2                                                           026660
      X4=X*X3                                                           026670
      F=(X4+A1*X3+A2*X2+A3*X1+A4)/(X4+B1*X3+B2*X2+B3*X1+B4)             026680
      E=F*EXP(-X)/X                                                     026690
      RETURN                                                            026700
  200 A1=4.03640                                                        026710
      A2=1.15198                                                        026720
      B1=5.03637                                                        026730
      B2=4.19160                                                        026740
      X1=X                                                              026750
      X2=X*X1                                                           026760
      F=(X2+A1*X1+A2)/(X2+B1*X1+B2)                                     026770
      E=F*EXP(-X)/X                                                     026780
      RETURN                                                            026790
      END                                                               026800
      SUBROUTINE COMP(SG)                                               026810
      COMMON /MESH/ T(21),G(101),W(21)                                  026820
      COMMON /EFUN/ E3T(21),E2T(101),E3TT(101),E3T1(101),E2TT(101)      026830
      COMMON /PARA/J0,N,N1,N2,NN,NNP1,REF                               026840
      DIMENSION GM(101)                                                 026850
      SUM=0.                                                            026860
      DO 10 K=1,NN                                                      026870
      KP1=K+1                                                           026880
      GM(K)=G(K)+G(KP1)                                                 026890
   10 SUM=SUM+GM(K)*(E3TT(KP1)-E3TT(K))                                 026900
      SG=SUM*.5                                                         026910
      RETURN                                                            026920
      END                                                               026930
      FUNCTION S11(X)                                                   026940
      COMMON /COEFF/ A(20),AA(20)                                       026950
      COMMON /PARA/J0,N,N1,N2,NN,NNP1,REF                               026960
      S11=0.                                                            026970
      DO 10 J=1,N1                                                      026980
   10 S11=S11+AA(J)*SE(J,X)                                             026990
      RETURN                                                            027000
      END                                                               027010
      FUNCTION SE(J,X)                                                  027020
      COMMON /MESH/ T(21),G(101),W(21)                                  027030
      COMMON /PARA/J0,N,N1,N2,NN,NNP1,REF                               027040
      IF(J.EQ.1) GO TO 100                                              027050
      IF(J.EQ.N-1) GO TO 200                                            027060
      IF(X.LE.T(J)) GO TO 300                                           027070
      IF(X.GE.T(J+1)) GO TO 400                                         027080
      SE=2.0-E2(X-T(J))-E2(T(J+1)-X)                                    027090
      RETURN                                                            027100
  300 SE=E2(T(J)-X)-E2(T(J+1)-X)                                        027110
      RETURN                                                            027120
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  400 SE=E2(X-T(J+1))-E2(X-T(J))                                        027130
      RETURN                                                            027140
  100 IF(X.GE.T(2)) GO TO 500                                           027150
      SE=2.-E2(X)-E2(T(2)-X)                                            027160
      RETURN                                                            027170
  500 SE=E2(X-T(2))-E2(X)                                               027180
      RETURN                                                            027190
  200 IF(X.GE.T(N-1)) GO TO 600                                         027200
      SE=E2(T(N-1)-X)-E2(T(N)-X)                                        027210
      RETURN                                                            027220
  600 SE=2.0-E2(X-T(N-1))-E2(T(N)-X)                                    027230
      RETURN                                                            027240
      END                                                               027250
      FUNCTION SINT(I)                                                  027260
      DIMENSION GM(101)                                                 027270
      COMMON /MESH/ T(21),G(101),W(21)                                  027280
      COMMON /EFUN/ E3T(21),E2T(101),E3TT(101),E3T1(101),E2TT(101)      027290
      COMMON /PARA/U0,N,N1,N2,NN,NNP1,REF                               027300
      SUM1=0.                                                           027310
      SUM2=0.                                                           027320
      DO 10 K=1,NN                                                      027330
      KP1=K+1                                                           027340
   10 GM(K)=G(K)+G(KP1)                                                 027350
      IF(I.EQ.1) GO TO 100                                              027360
      I1=I-1                                                            027370
      DO 20 K=1,I1                                                      027380
   20 SUM1=SUM1+GM(K)*(E2T(I-K)-E2T(I-K+1))                             027390
      IF (I.EQ.NNP1) GO TO 200                                          027400
  100 DO 30 K=I,NN                                                      027410
   30 SUM2=SUM2+GM(K)*(E2T(K-I+2)-E2T(K-I+1))                           027420
  200 SINT=(SUM1-SUM2)*.5                                               027430
      RETURN                                                            027440
      END                                                               027450
      BLOCK DATA                                                        027460
C..... CHLORINE MODEL STUDY PROGRAM - VERSION 4                         027470
C                                                                       027480
C.....BLOCK DATA                                                        027490
C                                                                       027500
C.....VERSION 4.0       LEVEL 770214                                    027510
C.....E.R.T.,INC.       L.PERRY, N.TRIPP                                027520
C                                                                       027530
C.......................................................................027540
      REAL TITLE(6)                                                     027550
C                                                                       027560
C+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++027570
      COMMON   /HEAD/ TITLE,ICODE,VERS,LEVEL,DATE,IRUN,NPAGE,NLOG      027580
      COMMON /EDDY/ FKK,I1,P11,P22,NEDDY                                027590
      COMMON /MODEL/ ALT(41),TEMP(41),DM(41),DIO(41),DA23(41)           027600
      COMMON /MOLWD/ XM(81),XM2O(81),PM2O,R42,X11(81)                   027610
      COMMON /MSCAT/ SCNO2,SCCLO3,SCH2O2,SCN2O5                         027620
      REAL JO2, JO3, JH2O, JNO2, JN2O, JN2O5, JHNO3, JCH4, JCF2,        027630
     X              JCF3, JHCL, JH2O2,JHOCL                            027640
      COMMON /PARM/ ISWIT,TSTEP,TSTOP,TLOOP,ITPRNT,ISIZE,ISCATT         027650
      COMMON /PHRATE/ JO2(41),JO3(41),JH2O(41),JNO2(41),JN2O(41),       027660
     X JN2O5(41),JHNO3(41),JCH4(41),JCF2(41),JCF3(41),JHCL(41),JH2O2(41)027670
     Y ,JHOCL(41)                                                       027680
      REAL JNO3                                                         027690
      COMMON /RATES/ RATE(65,81),RA(65),RB(65),JNO3,PJO3                027700
      COMMON /RLOW/ RN2O,RNOX,RCH4,RF11,RF12,RCH3C,RCLX,RCCL4,RO3       027710
      COMMON /SFACT/ FCL,FH2O,FCLNO3,FNO                                027720
      COMMON /SOLCON/ WL(100),FL(100),QO2(100),QO3(100)                 027730
      COMMON /SOLCN1/ QCF2(100),QCF3(100),QCCL4(100),QCH3C(100),        027740
     X QCLNO3(100),QN2O(100),QHNO3(100),QH2O2(100),QN2O5(100),          027750
     Y QHCL(100),QHOCL(100),QNO2(100),QH2O(100)                         027760
      REAL NO,NO2,NOX,NO3,N2O5                                          027770
      COMMON /SPECIE/ H(41),OH(41),HO2(41),H2O2(41),O3(41),O(41),NO(41),027780
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     1 NO2(41),HNO3(41),NOX(41),CO(41),O2(41),CH4(41),H2O(41),H2(41),    027790
     2 CL(41),CLO(41),HCL(41),CLX(41),OCLX(41),NO3(41),N2O5(41),         027800
     3 CLNO3(41)                                                         027810
      COMMON /SPECON/ FJ,FJFC,TL                                         027820
      REAL LAT                                                           027830
      COMMON /MT/ A(6),DL,LAT,DEL                                        027840
      COMMON /XXES/ X1(81),X2(81),X3(81),X4(81),X5(81),X6(81),X7(81),    027850
     1 X8(81),X9(81),X10(81)                                             027860
C*****************************************************************     027870
C                                                                        027880
      DATA TITLE/5HCHLORINE,8H MODEL S,8HTUDY PRO,4HGRAM,14 ,1H /,       027890
     X           DATE/1H /,NLOG/9/,IRUN/0/,NPAGE/0/                      027900
      DATA JNO3/1.3E-2/                                                  027910
      DATA FCL,FCLNO3,FH2O/1.0,1.00,1.0/,FNO/1.0/                        027920
      DATA RN2O,RNOX,RCH4,RF11,RF12,RCH3C,RCLX,RCCL4/2.50E-7,2.00E10,    027930
     1 1.50E-06,9.30E+06,1.30E+07,1.50E-09,1.00E+10,1.30E-10/            027940
      DATA RO3/3.00E-08/                                                 027950
      DATA FJ,FJFC,TL/1.0,1.0,3.15E13/,FKK/1.0/,ISWIT/1/,NEDDY/0/        027960
      DATA I1,P11,P22/59,1.0,1.0/,PJO3/1.8E-4/,LAT,DEL/30.,0./           027970
      DATA SCNO2,SCCLO3,SCH2O2,SCN2O5/4*1.0/                             027980
      DATA RH2,PH2O/5.E-7,0./                                            027990
      DATA X2/81*0./                                                     028000
C     - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -    028010
      DATA RA/1.66E-12,2.35E-10,1.4E-10,1.0E-10,1.8E-32,2.6E-11,2.3E-12, 028020
     A 1.0E-11,1.0E-13,1.0E-10,1.1E-11,0.,5.0E-12,2.0E-11,3.0E-11,       028030
     B 1.0E-11,4.2E-10,2.1E-13,1.0E-10,2.0E-12,2.36E-12,0.,1.0E-12,      028040
     C 1.7E-12,6.7E-12,5.7E-11,6.0E-13,3.8E-33,2.7E-11,7.23E-12,         028050
     D 1.07E-10,2.0E-11,0.,1.05E-34,1.3E-11,1.0E-12,0.,3.7E-11,9.0E-6,   028060
     E 2.30E-12,1.2E-13,9.12E-12,5.0E-11,7.0E-11,2.8E-11,5.5E-12,        028070
     F 3.0E-10,3.0E-10,2*0.,2.0E-11,14*0./                               028080
      DATA RB/-1070.,3*0.,340.,0.,-1125.,-750.,-1525.,-250.,-1000.,0.,    028090
     X -500.,3*0.,-350.,-115.,-250.,                                     028100
     A              -313.,-1710.,0.,-600.,0.,-2010.,-2400.,0.,1055.,     028110
     B -257.,-1260.,-224.,2*0.,520.,-2140.,3*0.,-3700.,-1450.,-2450.,    028120
     C 4*0.,-3200.,4*0.,107.,14*0./                                      028130
C     - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -    028140
      DATA WL/937.8,949.7,970.0,972.5,977.0,1008.0,991.5,1026.8,1035.0,   028150
     2 1050.0,1110.0,1155.0,1190.0,1210.0,1215.7,1250.0,1300.0,1350.0,   028160
     3 1400.0,1450.0,1500.0,1550.0,1600.0,1650.0,1700.0,1750.0,1800.0,   028170
     4 1830.0,1900.0,1950.0,2000.0,2050.0,2100.0,2150.0,2200.0,2250.0,   028180
     5 2300.0,2350.0,2400.0,2450.0,2500.0,2550.0,2575.0,2625.0,2675.0,   028190
     6 2725.0,2775.0,2825.0,2875.0,2925.0,2975.0,3025.0,3075.0,3125.0,   028200
     7 3175.0,3225.0,3275.0,3325.0,3375.0,3425.0,3475.0,3525.0,3575.0,   028210
     8 3625.0,3675.0,3725.0,3775.0,3825.0,3875.0,3925.0,3975.0,4025.0,   028220
     9 4100.0,4200.0,4300.0,4400.0,4500.0,4600.0,4700.0,4800.0,4900.0,   028230
     A 5000.0,5100.0,5200.0,5300.0,5400.0,5500.0,5600.0,5700.0,5800.0,   028240
     B 5900.0,6000.0,6200.0,6400.0,6600.0,6800.0,7000.0,7200.0,7300.0/   028250
C     - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -    028260
      DATA   FL/2.2000E+08,3.9000E+08,6.1000E+08,9.0000E+08,4.4000E+09,   028270
     2 5.3000E+08,4.0000E+07,3.5000E+03,3.9100E+09,4.6800E+09,4.4000E+09,028280
     3 3.3000E+09,5.5000E+09,1.1700E+10,2.7000E+11,2.6000E+10,1.1500E+10,028290
     4 1.7700E+10,1.9300E+10,3.7000E+10,7.3000E+10,1.3300E+11,2.1600E+11,028300
     5 2.0600E+11,2.5800E+11,4.3000E+11,9.1000E+11,1.3100E+12,2.2500E+12,028310
     6 3.9000E+12,5.9000E+12,8.7000E+12,1.4400E+13,2.3800E+13,3.1600E+13,028320
     7 3.8300E+13,3.8300E+13,3.5400E+13,3.6800E+13,4.6300E+13,4.1500E+13,028330
     8 7.1600E+13,4.0800E+13,1.1200E+14,1.5100E+14,1.6200E+14,1.6100E+14,028340
     9 2.0600E+14,3.1100E+14,4.2400E+14,4.6400E+14,4.8700E+14,5.1500E+14,028350
     A 6.2200E+14,6.5200E+14,6.9500E+14,9.3300E+14,9.5900E+14,9.3300E+14,028360
     B 9.9000E+14,9.3100E+14,1.1000E+15,1.0200E+15,1.1100E+15,1.1300E+15,028370
     C 1.1700E+15,1.3300E+15,1.1400E+15,1.1600E+15,1.1600E+15,1.1700E+15,028380
     D 1.3800E+15,2.3900E+15,4.0100E+15,3.9500E+15,4.2300E+15,4.1800E+15,028390
     E 4.9700E+15,5.0500E+15,5.2000E+15,4.9000E+15,5.0100E+15,4.9900E+15,028400
     F 4.8600E+15,5.1000E+15,5.3100E+15,5.3800E+15,5.3200E+15,5.3400E+15,028410
     G 5.4000E+15,5.4200E+15,5.4400E+15,1.0800E+16,1.0700E+16,1.1500E+16,028420
     H 1.0300E+16,1.0100E+16,9.9300E+15,4.9000E+15/                      028430
C     - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -    028440
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      DATA QO2/5.2000E-18,5.9000E-18,5.5000E-18,4.0000E-17,2.0000E-18,   028450
     21.9000E-18,1.9000E-18,1.6000E-18,1.2000E-18,1.0000E-18,1.0000E-19,028460
     34.0000E-19,3.6000E-19,4.6000E-18,1.0000E-20,1.0000E-18,5.5000E-19,028470
     44.0000E-18,1.0000E-17,1.0000E-17,1.0000E-17,8.4000E-18,4.3000E-18,028480
     54.3000E-18,8.8000E-19,2.7000E-19,6.0000E-21,5.5000E-22,1.0000E-21,028490
     62.0000E-23,1.3000E-23,1.0000E-23,8.5000E-24,6.5000E-24,5.0000E-24,028500
     74.0000E-24,3.0000E-24,1.6800E-24,1.0000E-24,7.0000E-25,3.0000E-25,028510
     81.2000E-25,30*0./                                                 028520
C     - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - 028530
      DATA QO3/24*0.,8.3500E-19,8.3500E-19,7.4190E-19,6.6670E-19,        028540
     24.7000E-19,4.0740E-19,2.9630E-19,3.3330E-19,5.9260E-19,1.0500E-18,028550
     31.8600E-18,2.9000E-18,4.4000E-18,6.2000E-18,8.1000E-18,9.9000E-18,028560
     41.1000E-17,1.1300E-17,1.1000E-17,1.0000E-17,8.6000E-18,6.4000E-18,028570
     54.5000E-18,2.7000E-18,1.6000E-18,1.0000E-18,4.7000E-19,2.6000E-19,028580
     61.4000E-19,6.8000E-20,3.6000E-20,1.8000E-20,7.7000E-21,4.1000E-21,028590
     72.0000E-21,6.9000E-22,4.0000E-22,2.5000E-22,10*0.00000,2.9000E-23,028600
     84.0000E-23,6.8000E-23,1.2500E-22,1.7100E-22,3.5700E-22,4.0600E-22,028610
     97.1000E-22,9.3000E-22,1.2000E-21,1.6000E-21,1.8800E-21,2.5000E-21,028620
     A2.9000E-21,3.2000E-21,3.9000E-21,4.7000E-21,4.6000E-21,4.4000E-21,028630
     84.9000E-21,3.9000E-21,2.7000E-21,2.1000E-21,1.4000E-21,9.1000E-22,028640
     C6.4000E-22,5.1000E-22/                                            028650
C     - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - 028660
      DATA TEMP/3.0458E+02,2.8956E+02,2.7787E+02,2.6652E+02,2.5241E+02,  028670
     22.3839E+02,2.2442E+02,2.1050E+02,2.0315E+02,2.0738E+02,2.1175E+02,028680
     32.1594E+02,2.1920E+02,2.2384E+02,2.2783E+02,2.3179E+02,2.3574E+02,028690
     42.4040E+02,2.4514E+02,2.4988E+02,2.5462E+02,2.5935E+02,2.6408E+02,028700
     52.6880E+02,2.7215E+02,2.7215E+02,2.7114E+02,2.6721E+02,2.6328E+02,028710
     62.5936E+02,2.5479E+02,2.4735E+02,2.3991E+02,2.3247E+02,2.2504E+02,028720
     72.1761E+02,2.1019E+02,2.0277E+02,1.9536E+02,1.8795E+02,1.8054E+02/028730
C     - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - 028740
      DATA DM/2.4110E+19,2.1050E+19,1.6510E+19,1.3400E+19,1.0880E+19,    028750
     28.7330E+18,6.9130E+18,5.9310E+18,4.1030E+18,2.8240E+18,2.0000E+18,028760
     31.4290E+18,1.0320E+18,7.4450E+17,5.4230E+17,3.9700E+17,2.9240E+17,028770
     42.1590E+17,1.6040E+17,1.1980E+17,8.9990E+16,6.7980E+16,5.1610E+16,028780
     53.9390E+16,3.0350E+16,2.3720E+16,1.8600E+16,1.4710E+16,1.1590E+16,028790
     69.1050E+15,7.1440E+15,5.6360E+15,4.4160E+15,3.4350E+15,2.6620E+15,028800
     72.0260E+15,1.5350E+15,1.1520E+15,8.5540E+14,6.2810E+14,4.5560E+14/028810
C     - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - 028820
      DATA  O3/6.2500E+11,6.1300E+11,5.3100E+11,4.7800E+11,4.4900E+11,   028830
     24.1800E+11,5.2500E+11,6.5200E+11,2.6700E+12,3.7400E+12,4.4700E+12,028840
     34.8000E+12,4.8700E+12,4.4700E+12,3.9100E+12,3.2500E+12,2.5700E+12,028850
     41.9200E+12,1.3800E+12,9.6600E+11,6.6200E+11,4.4300E+11,2.8300E+11,028860
     51.8100E+11,1.1400E+11,7.4600E+10,4.9300E+10,3.4000E+10,2.3200E+10,028870
     61.5700E+10,1.0600E+10,7.5400E+09,5.2900E+09,3.5200E+09,2.2600E+09,028880
     71.3700E+09,9.5600E+08,5.0700E+08,3.1700E+08,2.0300E+08,1.3200E+08/028890
C     - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - 028900
      DATA  OH/1.6100E+06,1.2400E+06,1.0600E+06,1.0100E+06,7.3200E+05,   028910
     24.9600E+05,3.4100E+05,1.9400E+05,2.0000E+05,2.7000E+05,3.4400E+05,028920
     34.3300E+05,5.5400E+05,7.1200E+05,9.3200E+05,1.2600E+06,1.7300E+06,028930
     42.4300E+06,3.3800E+06,4.5900E+06,5.9800E+06,7.2600E+06,8.1000E+06,028940
     57.9600E+06,7.4000E+06,6.7300E+06,6.0100E+06,5.3800E+06,4.7600E+06,028950
     64.1800E+06,3.6700E+06,3.1600E+06,2.6700E+06,2.3400E+06,2.1000E+06,028960
     71.9200E+06,1.7000E+06,1.5500E+05,1.2800E+06,9.8900E+05,7.1050E+05/028970
C     - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - 028980
      DATA  O/2.8900E+03,2.8900E+03,3.4800E+03,3.6300E+03,4.6100E+03,    028990
     25.9800E+03,1.0400E+04,1.5000E+04,1.1500E+05,3.6400E+05,9.2900E+05,029000
     32.1100E+06,4.4200E+06,8.6700E+06,1.6000E+07,2.8400E+07,4.1850E+07,029010
     43.1700E+07,1.3500E+08,2.2100E+08,3.6500E+08,6.0800E+08,9.8300E+08,029020
     51.4700E+09,2.0000E+09,2.5500E+09,3.1200E+09,3.6900E+09,4.2500E+09,029030
     64.8100E+09,5.3300E+09,5.9200E+09,6.5100E+09,6.8300E+09,6.9100E+09,029040
     76.8300E+09,6.9400E+09,6.8400E+09,7.2800E+09,8.0900E+09,9.4000E+09/029050
C     - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - 029060
      DATA  H/1.2100E-01,8.8000E-02,8.1500E-02,8.0000E-02,5.9100E-02,    029070
     24.1500E-02,2.8700E-02,1.5400E-02,1.4000E-02,2.1000E-02,3.2700E-02,029080
     35.7700E-02,1.1500E-01,2.5800E-01,6.2700E-01,1.6800E+00,5.0300E+00,029090
     41.7000E+01,5.1100E+01,2.2700E+02,8.3300E+02,2.9000E+03,8.1900E+03.029100
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     52.2700E+04,4.8500E+04,9.0900E+04,1.5800E+05,2.5800E+05,4.0900E+05,029110
     66.3200E+05,9.5800E+05,1.3800E+06,1.9500E+06,2.7800E+06,3.9900E+06,029120
     75.9900E+06,8.6900E+06,1.3100E+07,1.9200E+07,2.7500E+07,3.8100E+07/029130
C    - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - 029140
     DATA  HO2/2.4200E+08,1.7600E+08,1.3100E+08,1.2500E+08,8.1500E+07,  029150
     25.0400E+07,3.1500E+07,1.8100E+07,1.5800E+07,1.7900E+07,2.0400E+07,029160
     32.2900E+07,2.5400E+07,2.6700E+07,2.7000E+07,2.5800E+07,2.3000E+07,029170
     41.9200E+07,1.5100E+07,1.1700E+07,9.2300E+06,7.6900E+06,6.1200E+06,029180
     55.9200E+06,5.1800E+06,4.5500E+06,3.9600E+06,3.4600E+06,3.0000E+06,029190
     62.5900E+06,2.2300E+06,1.8700E+05,1.5400E+06,1.3300E+06,1.1900E+06,029200
     71.0800E+06,9.5200E+05,8.6700E+05,7.0500E+05,5.2500E+05,3.5500E+05/029210
C    - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - 029220
     DATA  H2O2/2.1000E+10,2.5000E+10,1.8000E+10,1.2000E+10,1.1300E+10,029230
     25.3000E+09,4.5000E+09,1.4000E+09,9.9400E+07,2.4100E+07,3.9400E+07,029240
     34.4200E+07,4.1500E+07,3.5500E+07,3.0100E+07,2.4800E+07,2.1200E+07,029250
     42.0800E+07,1.8600E+07,1.6100E+07,1.3300E+07,1.0700E+07,8.4500E+06,029260
     56.3800E+06,4.5800E+06,3.2000E+06,2.2400E+06,1.6000E+06,1.1300E+06,029270
     67.9800E+05,5.7400E+05,3.8600E+05,2.4600E+05,1.7100E+05,1.2300E+05,029280
     79.5900E+04,7.2300E+04,5.9300E+04,3.8300E+04,2.0500E+04,9.0200E+03/029290
C    - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - 029300
     DATA JHCL/1.3476E-29,1.7155E-26,1.0596E-23,3.5073E-21,6.9259E-19,  029310
     26.7111E-17,3.1183E-15,8.7227E-14,1.5159E-12,1.4303E-11,8.4891E-11,029320
     33.6315E-10,1.2327E-09,3.4042E-09,7.9316E-09,1.5998E-08,2.8437E-08,029330
     44.5049E-08,6.4398E-08,8.4481E-09,1.0523E-07,1.2410E-07,1.4043E-07,029340
     51.5440E-07,1.6726E-07,1.7994E-07,1.9339E-07,2.0849E-07,2.2585E-07,029350
     62.4560E-07,2.6740E-07,2.9069E-07,3.1487E-07,3.4177E-07,3.6896E-07,029360
     74.0039E-07,4.3648E-07,4.7911E-07,5.2843E-07,5.8180E-07,6.3504E-07/029370
C    - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - 029380
     DATA JCH4/25*0.,1.0289E-27,3.2369E-23,1.1507E-19,7.5248E-17,       029390
     21.2647E-14,7.2754E-13,1.8015E-11,2.3133E-10,1.7445E-09,8.5503E-09,029400
     33.0106E-08,7.3105E-08,1.6859E-07,3.0472E-07,4.8102E-07,6.7959E-07/029410
C    - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - 029420
     DATA DID/2.9228E-03,3.3919E-03,3.8611E-03,4.3988E-03,5.1697E-03,   029430
     26.1919E-03,1.0078E-02,1.5063E-02,9.7713E-02,2.3901E-01,5.1692E-01,029440
     31.0496E+00,2.0826E+00,3.8613E+00,6.8855E+00,1.1820E+01,1.9289E+01,029450
     42.9819E+01,4.3466E+01,6.1222E+01,8.4508E+01,1.1458E+02,1.4672E+02,029460
     51.6955E+02,1.7919E+02,1.8142E+02,1.7690E+02,1.7115E+02,1.6057E+02,029470
     61.4725E+02,1.3288E+02,1.2417E+02,1.1422E+02,9.9626E+01,8.3651E+01,029480
     76.7259E+01,5.5916E+01,4.4580E+01,3.8082E+01,3.3875E+01,3.1108E+01/029490
C    - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - 029500
     DATA JN2O/3.3115E-10,3.3776E-10,3.4402E-10,3.4968E-10,3.5496E-10,  029510
     23.5999E-10,3.6561E-10,3.7298E-10,3.9724E-10,4.6762E-10,6.6381E-10,029520
     31.2383E-09,2.9256E-09,6.5720E-09,1.4198E-08,2.7762E-08,4.8867E-08,029530
     47.7590E-08,1.1187E-07,1.4846E-07,1.8706E-07,2.2282E-07,2.5396E-07,029540
     52.8033E-07,3.0302E-07,3.2303E-07,3.4130E-07,3.5868E-07,3.7595E-07,029550
     63.9349E-07,4.1144E-07,4.2975E-07,4.4813E-07,4.6727E-07,4.8608E-07,029560
     75.0774E-07,5.3259E-07,5.6308E-07,6.0045E-07,6.4319E-07,6.8785E-07/029570
C    - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - 029580
     DATA JN2O5/1.2807E-05,1.2864E-05,1.2918E-05,1.2965E-05,1.3010E-05,029590
     21.3052E-05,1.3098E-05,1.3157E-05,1.3330E-05,1.3694E-05,1.4245E-05,029600
     31.5057E-05,1.6326E-05,1.8306E-05,2.1404E-05,2.6320E-05,3.3719E-05,029610
     44.4228E-05,5.7854E-05,7.4327E-05,9.3804E-05,1.1526E-04,1.3777E-04,029620
     51.5999E-04,1.8017E-04,1.9764E-04,2.1265E-04,2.2476E-04,2.3475E-04,029630
     62.4284E-04,2.4919E-04,2.5410E-04,2.5789E-04,2.6070E-04,2.6267E-04,029640
     72.6400E-04,2.6488E-04,2.6546E-04,2.6584E-04,2.6610E-04,2.6627E-04/029650
C    - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - 029660
     DATA JHNO3/1.7653E-07,1.7967E-07,1.8265E-07,1.8533E-07,1.8783E-07,029670
     21.9022E-07,1.9287E-07,1.9629E-07,2.0680E-07,2.3252E-07,2.8660E-07,029680
     34.1257E-07,7.1813E-07,1.3894E-06,2.7000E-06,4.9742E-06,8.4498E-06,029690
     41.3130E-05,1.8690E-05,2.4671E-05,3.1130E-05,3.7342E-05,4.3095E-05,029700
     54.9260E-05,5.2789E-05,5.6697E-05,6.0084E-05,6.2996E-05,6.5600E-05,029710
     66.7984E-05,7.0208E-05,7.2324E-05,7.4349E-05,7.6237E-05,7.7946E-05,029720
     77.9638E-05,8.1042E-05,8.2214E-05,8.3244E-05,8.4143E-05,8.4903E-05/029730
C    - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - 029740
     DATA JH2O2/1.3571E-06,1.3663E-06,1.3750E-06,1.3828E-06,1.3900E-06,029750
     21.3968E-06,1.4044E-06,1.4140E-06,1.4421E-06,1.5017E-06,1.5916E-06,029760
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     31.7219E-06,1.3206E-06,2.2204E-06,2.6755E-06,3.3861E-06,4.4527E-06,029770
     46.0019E-06,5.1055E-06,1.0840E-05,1.4314E-05,1.8545E-05,2.3397E-05,029780
     52.3488E-05,3.3262E-05,3.7486E-05,4.1182E-05,4.4205E-05,4.6749E-05,029790
     64.3867E-05,5.0575E-05,5.1938E-05,5.3028E-05,5.3880E-05,5.4513E-05,029800
     75.4992E-05,5.5353E-05,5.5639E-05,5.5874E-05,5.6073E-05,5.6238E-05/029810
C    - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - 029820
     DATA  HNO3/4.74E+10,2.13E+10,1.09E+10,1.58E+10,1.22E+10,8.84E+09,  029830
     26.56E+09,4.63E+09,8.86E+09,1.03E+10,9.90E+09,8.16E+09,5.73E+09,   029840
     33.31E+09,1.75E+09,9.13E+08,4.84E+08,2.55E+08,1.33E+08,6.72E+07,   029850
     43.07E+07,1.18E+07,3.67E+06,9.55E+05,2.35E+05,6.09E+04,1.60E+04,   029860
     54.52E+03,1.26E+03,3.30E+02,8.95E+01,2.48E+01,6.86E+00,2.06E+00,   029870
     66.94E-01,7.66E-01,3.00E-01,1.37E-01,6.29E-02,2.99E-02,1.39E-02/   029880
C    - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - 029890
     DATA  NOX/2.99E-09,1.76E-09,1.33E-09,1.35E-09,1.36E-09,1.33E-09,   029900
     21.48E-09,1.60E-09,3.41E-09,5.45E-09,7.69E-09,1.00E-08,1.23E-08,   029910
     31.44E-08,1.62E-08,1.77E-08,1.87E-08,1.92E-08,1.93E-08,1.90E-08,   029920
     41.85E-08,1.77E-08,1.67E-08,1.55E-08,1.42E-08,1.29E-08,1.15E-08,   029930
     53.98E-09,8.50E-09,7.10E-09,5.83E-09,4.75E-09,3.89E-09,3.26E-09,   029940
     62.85E-09,7.91E-09,7.64E-09,7.84E-09,8.58E-09,1.02E-08,1.28E-08/   029950
C    - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - 029960
C    DATA  N2O/2.6E-07,2.6E-07,2.6E-07,2.6E-07,2.6E-07,2.6E-07,2.6E-07,029970
C    22.6E-07,2.57E-07,2.27E-07,1.87E-07,1.52E-07,1.29E-07,1.09E-07,    029980
C    39.20E-08,7.63E-08,6.23E-08,5.03E-08,4.03E-08,3.21E-08,2.56E-08,   029990
C    42.06E-08,1.66E-08,1.36E-08,1.12E-08,9.35E-09,7.89E-09,6.73E-09,   030000
C    55.80E-09,5.06E-09,4.46E-09,3.98E-09,3.58E-09,3.26E-09,3.01E-09,   030010
C    62.80E-09,2.64E-09,2.51E-09,2.42E-09,2.33E-09,2.3E-09/             030020
C    - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - 030030
     DATA  CH4/1.50E-06,1.49E-06,1.48E-06,1.48E-06,1.48E-06,1.47E-06,   030040
     21.47E-06,1.47E-06,1.40E-06,1.33E-06,1.25E-06,1.16E-06,1.06E-06,   030050
     39.68E-07,8.68E-07,7.69E-07,6.71E-07,5.79E-07,4.93E-07,4.17E-07,   030060
     43.52E-07,2.98E-07,2.55E-07,2.23E-07,2.00E-07,1.83E-07,1.71E-07,   030070
     51.62E-07,1.56E-07,1.51E-07,1.47E-07,1.45E-07,1.43E-07,1.41E-07,   030080
     61.40E-07,6*0./                                                    030090
C    - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - 030100
     DATA  CO/9.97E-08,9.53E-08,9.05E-08,8.60E-08,8.24E-08,7.98E-08,    030110
     27.42E-08,7.08E-08,4.60E-08,3.15E-08,2.39E-08,2.07E-08,2.02E-08,   030120
     32.14E-08,2.34E-08,2.56E-08,2.72E-08,2.80E-08,2.77E-08,2.68E-08,   030130
     42.57E-08,2.51E-08,2.54E-08,2.66E-08,2.90E-08,3.25E-08,3.75E-08,   030140
     54.41E-08,5.21E-08,6.14E-08,7.13E-08,8.11E-08,8.98E-08,9.63E-08,   030150
     69.33E-08,5.74E-07,1.10E-06,1.99E-06,3.59E-06,6.45E-06,1.17E-05/   030160
C    - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - 030170
     DATA  NO/6.61E+09,5.03E+09,4.40E+09,1.07E+09,1.48E+09,2.13E+09,    030180
     22.50E+09,3.46E+09,2.20E+09,1.60E+09,1.34E+09,1.26E+09,1.29E+09,   030190
     31.34E+09,1.35E+09,1.33E+09,1.28E+09,1.22E+09,1.15E+09,1.07E+09,   030200
     49.76E+08,8.58E+08,7.10E+08,5.51E+08,4.09E+08,2.97E+08,2.10E+08,   030210
     51.45E+08,9.90E+07,6.44E+07,4.16E+07,2.68E+07,1.72E+07,1.12E+07,   030220
     67.59E+06,1.60E+07,1.17E+07,9.03E+06,7.34E+06,6.41E+06,5.83E+06/   030230
C    - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - 030240
     DATA  NO2/1.81E+10,1.07E+10,6.70E+09,1.20E+09,1.16E+09,1.15E+09,   030250
     21.19E+09,1.39E+09,2.86E+09,3.32E+09,3.78E+09,4.29E+09,4.85E+09,   030260
     35.16E+09,4.97E+09,4.34E+09,3.49E+09,2.59E+09,1.79E+09,1.14E+09,   030270
     46.53E+08,3.30E+08,1.46E+08,5.88E+07,2.30E+07,9.03E+06,3.52E+06,   030280
     51.37E+06,5.22E+05,1.96E+05,7.29E+04,2.71E+04,1.02E+04,3.98E+03,   030290
     61.59E+03,2.36E+03,1.22E+03,7.09E+02,4.66E+02,3.46E+02,2.79E+02/   030300
C    - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - 030310
     DATA  H2/5.0000E-07,5.0000E-07,5.0000E-07,5.0000E-07,5.0000E-07,   030320
     25.0000E-07,5.0000E-07,5.0000E-07,5.0000E-07,5.0000E-07,5.0000E-07,030330
     35.0000E-07,5.0000E-07,5.0000E-07,5.0000E-07,5.0000E-07,5.0000E-07,030340
     45.0000E-07,5.0000E-07,5.0000E-07,5.0000E-07,5.0000E-07,5.0000E-07,030350
     55.0000E-07,5.0000E-07,5.0000E-07,5.0000E-07,5.0000E-07,5.0000E-07,030360
     65.0000E-07,5.0000E-07,1.0000E-06,1.6000E-06,2.2000E-06,2.9000E-06,030370
     73.9000E-06,4.4000E-06,4.5000E-06,4.3000E-06,4.2000E-06,4.1000E-06/030380
C    - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - 030390
     DATA  JNO2/4.3974E-03,4.3992E-03,4.4009E-03,4.4024E-03,4.4038E-03, 030400
     24.4051E-03,4.4065E-03,4.4083E-03,4.4134E-03,4.4238E-03,4.4381E-03,030410
     34.4558E-03,4.4775E-03,4.5019E-03,4.5277E-03,4.5553E-03,4.5829E-03,030420
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     4.5104E-03,4.6360E-03,4.6598E-03,4.6810E-03,4.6999E-03,4.7159E-03,030430
     4.7291E-03,4.7394E-03,4.7474E-03,4.7536E-03,4.7583E-03,4.7619E-03,030440
     4.7646E-03,4.7667E-03,4.7687E-03,4.7702E-03,4.7710E-03,4.7720E-03,030450
     4.7723E-03,4.7728E-03,4.7733E-03,4.7733E-03,4.7737E-03,4.7737E-03/030460
C    - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - 030470
      DATA JCF2/4.0383E-29,6.7920E-26,4.6511E-23,1.6649E-20,3.4437E-18, 030480
     3.3930E-16,1.5605E-14,4.1950E-13,6.8864E-12,6.2006E-11,3.5744E-10,030490
     1.5095E-09,5.1218E-09,1.4246E-08,3.3557E-08,6.8392E-08,1.2268E-07,030500
     1.9576E-07,2.8127E-07,3.7010E-07,4.6109E-07,5.4441E-07,6.1635E-07,030510
     6.7728E-07,7.3306E-07,7.8765E-07,8.4524E-07,9.0972E-07,9.8409E-07,030520
     1.0693E-06,1.1642E-06,1.2662E-06,1.3715E-06,1.4831E-06,1.5852E-06,030530
     1.6855E-06,1.7735E-06,1.8506E-06,1.9193E-06,1.9193E-06,2.0290E-06/030540
C    - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - 030550
      DATA JCF3/2.4654E-27,3.0229E-24,1.5298E-21,3.4449E-19,5.0888E-17, 030560
     4.3030E-15,1.8292E-13,4.6028E-12,7.0755E-11,6.0305E-10,3.3214E-09,030570
     1.3478E-08,4.4144E-08,1.1916E-07,2.7409E-07,5.5114E-07,9.8385E-07,030580
     1.5742E-06,2.2816E-06,3.0398E-06,3.8463E-06,4.5932E-06,5.2451E-06,030590
     5.7977E-06,6.2725E-06,6.6895E-06,7.0691E-06,7.4289E-06,7.7937E-06,030600
     8.1405E-06,8.5016E-06,8.8656E-06,9.2254E-06,9.5906E-06,9.9197E-06,030610
     1.0238E-05,1.0514E-05,1.0752E-05,1.0962E-05,1.1145E-05,1.1297E-05/030620
C    - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - 030630
      DATA  H2O/2.2717E-02,1.1092E-02,6.7620E-03,3.5483E-03,1.2747E-03, 030640
     4.0172E-04,1.0814E-04,2.1832E-05,4.2000E-06,4.2000E-06,4.2000E-06,030650
     4.2000E-06,4.2000E-06,4.2000E-06,4.2000E-06,4.2000E-06,4.2000E-06,030660
     4.2000E-06,4.2000E-06,4.2000E-06,4.2000E-06,4.2000E-06,4.2000E-06,030670
     4.2000E-06,4.2000E-06,4.2000E-06,4.2000E-06,4.2000E-06,4.2000E-06,030680
     4.2000E-06,4.2000E-06,3.6000E-06,2.9000E-06,2.6000E-06,2.3000E-06,030690
     1.3000E-06,1.3000E-06,1.0000E-06,6.7000E-07,4.4000E-07,2.9000E-07/030700
C    - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - 030710
      DATA JH2O/8.1806E-67,8.1806E-67,2.2712E-31,3.1934E-27,7.6346E-24, 030720
     4.2150E-21,6.6966E-19,4.4976E-17,1.3713E-15,1.8280E-14,1.4238E-13,030730
     7.8392E-13,3.3426E-12,1.1276E-11,3.0938E-11,7.0234E-11,1.3649E-10,030740
     2.3139E-10,3.4800E-10,4.7399E-10,5.9999E-10,7.3020E-10,8.7195E-10,030750
     1.0725E-09,1.4382E-09,2.0754E-09,3.0979E-09,4.5909E-09,6.5824E-09,030760
     9.0177E-09,1.1798E-08,1.4922E-08,1.8869E-08,2.6066E-08,4.1000E-08,030770
     7.4037E-08,1.3761E-07,2.4305E-07,3.8386E-07,5.8130E-07,7.8685E-07/030780
C    - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - 030790
      DATA JO3/2.9315E-05,2.9694E-05,3.0051E-05,3.0373E-05,3.0674E-05,  030800
     3.0960E-05,3.1279E-05,3.1686E-05,3.2891E-05,3.5506E-05,3.9544E-05,030810
     4.5423E-05,5.4081E-05,6.6396E-05,8.3774E-05,1.0940E-04,1.4673E-04,030820
     2.0226E-04,2.8193E-04,3.9934E-04,5.7774E-04,8.5549E-04,1.2515E-03,030830
     1.7333E-03,2.2239E-03,2.6768E-03,3.0877E-03,3.4194E-03,3.6993E-03,030840
     3.9344E-03,4.1230E-03,4.2709E-03,4.3859E-03,4.4706E-03,4.5289E-03,030850
     4.5668E-03,4.5906E-03,4.6055E-03,4.6146E-03,4.6204E-03,4.6242E-03/030860
C    - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - 030870
      DATA JO2/2.8970E-31,3.1074E-28,1.4126E-25,2.5237E-23,2.6991E-21,  030880
     1.7903E-19,6.5744E-18,1.4959E-15,2.1357E-15,1.7354E-14,9.2769E-14,030890
     3.7073E-13,1.2105E-12,3.3061E-12,7.7843E-12,1.6251E-11,3.0572E-11,030900
     5.2363E-11,8.2376E-11,1.2038E-10,1.6697E-10,2.1867E-10,2.7155E-10,030910
     3.2242E-10,3.6953E-10,4.1477E-10,4.6269E-10,5.1803E-10,5.8584E-10,030920
     6.6887E-10,7.6743E-10,8.8054E-10,1.0076E-09,1.1568E-09,1.3310E-09,030930
     1.5628E-09,1.8491E-09,2.1997E-09,2.6087E-09,3.0475E-09,3.4791E-09/030940
C    - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - 030950
      DATA QCF2/ 27*0.,9.12E-19,5.70E-19,2.46E-19,9.02E-20,3.11E-20,    030960
     1 9.76E-21,2.00E-21,38*0./                                         030970
      DATA QCF3/ 27*0.,2.41E-18,1.80E-18,1.13E-18,6.56E-19,3.49E-19,    030980
     1 1.52E-19,6.40E-20,2.47E-20,1.00E-20,36*0./                       030990
      DATA QCCL4 /27*0.,3.36E-18,1.36E-18,7.33E-19,6.92E-19,6.25E-19,   031000
     1  4.54E-19,3.01E-19,1.75E-19,7.00E-20,36*0./                      031010
      DATA QCH3C/25*0.,5.5E-19,3.55E-19,1.80E-19,7.68E-20,3.02E-20,     031020
     2 9.83E-21,3.42E-21,9.10E-22,2.30E-22,5.00E-23,37*0./              031030
      DATA  QCLNO3/28*0.,,8.0E-18,5.3E-18,3.5E-18,3.4E-18,3.4E-18,3.3E-18031040
     2,3.2E-18,3.2E-18,2.3E-18,1.6E-18,1.2E-18,8.4E-19,6.3E-19,4.7E-19, 031050
     3 4.2E-19,3.8E-19,2.6E-19,2.2E-19,1.6E-19,1.3E-19,8.5E-20,6.3E-20, 031060
     4 3.8E-20,3.0E-20,2.3E-20,1.6E-20,1.2E-20,8.3E-21,6.4E-21,4.6E-21, 031070
     5 3.1E-21,2.6E-21,2.2E-21,1.7E-21,1.1E-21,7.1E-22,8*0./            031080
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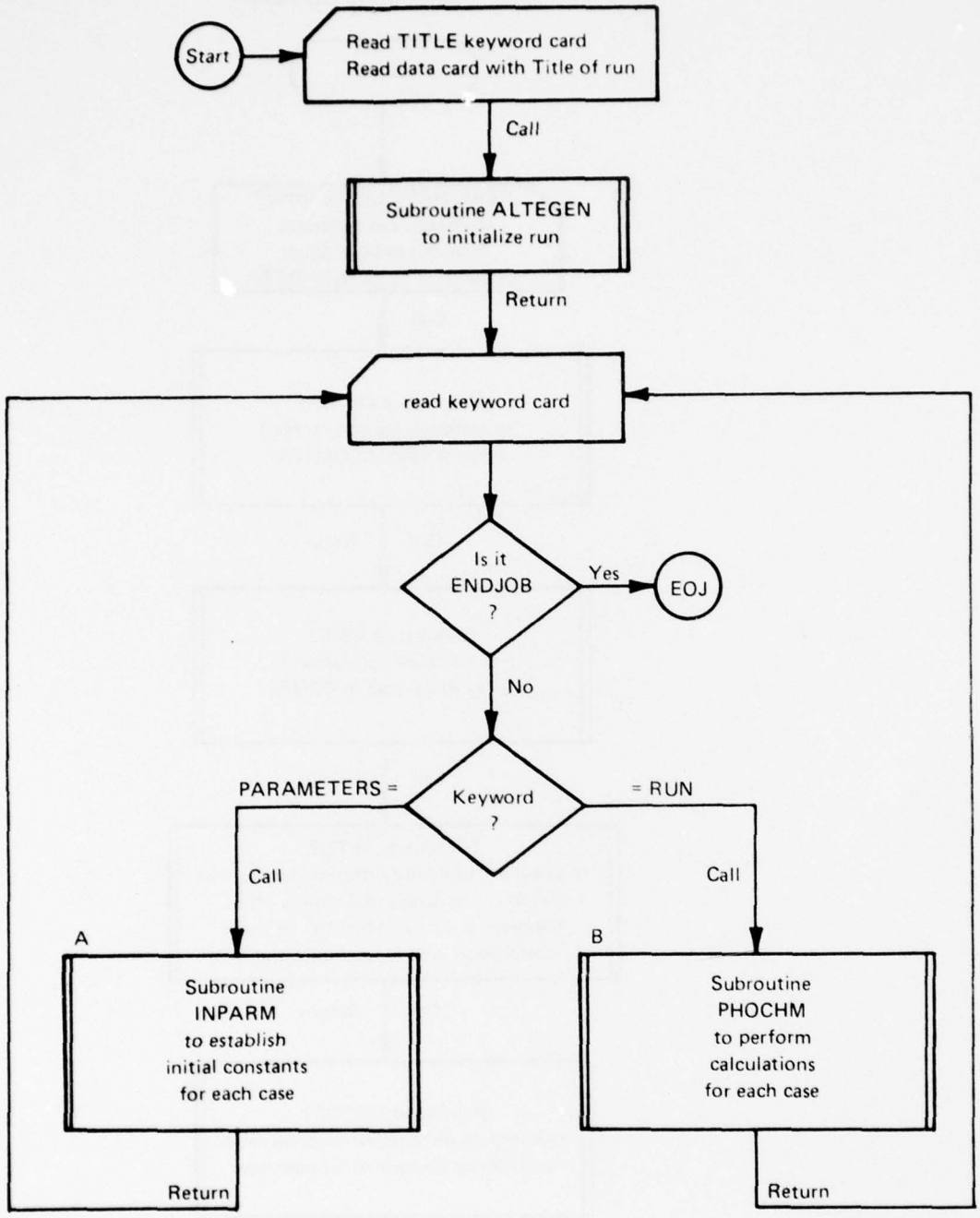
      DATA QN2O/ 8*0.,3.7E-17,3.7E-17,3.7E-17,1.5E-17,3.7E-18,2.6E-18,  031090
     2 2.6E-18,1.7E-17,8.9E-17,3.7E-19,5.0E-19,4.0E-18,1.0E-18,1.0E-19,  031100
     3 3.0E-20,4.0E-20,7.0E-20,9.0E-20,1.1E-19,1.1E-19,1.0E-19,6.0E-20,  031110
     4 3.3E-20,1.5E-20,6.0E-21,2.5E-21,1.1E-21,3.0E-22,1.0E-22,3.2E-23,  031120
     5 1.5E-23,7.6E-24,5.0E-24,2.0E-24,6.8E-25,4.0E-25,28*0./            031130
      DATA QHNO3/28*0.,1.32E-17,9.10E-18,5.5E-18,2.55E-18,9.7E-19,       031140
     2 3.28E-19,1.44E-19,8.51E-20,5.63E-20,3.74E-20,2.60E-20,2.10E-20,   031150
     3 1.95E-20,1.94E-20,1.90E-20,1.80E-20,1.63E-20,1.40E-20,1.14E-20,   031160
     4 8.77E-21,6.34E-21,4.26E-21,2.75E-21,1.68E-21,9.50E-22,4.70E-22,   031170
     5 1.80E-22,1.00E-22,1.00E-23,1.00E-24,1.00E-24,13*0./               031180
      DATA QH2O2/26*0.,1.5E-18,1.2E-19,7.5E-19,6.2E-19,4.9E-19,4.3E-19,  031190
     2 3.8E-19,3.4E-19,3.0E-19,2.4E-19,1.9E-19,1.5E-19,1.3E-19,1.1E-19,  031200
     3 8.4E-20,6.5E-20,5.3E-20,3.8E-20,3.0E-20,2.3E-20,1.9E-20,1.4E-20,  031210
     4  1.1E-20,8.1E-21,5.8E-21,3.4E-21,2.7E-21,1.9E-21,1.3E-21,6.5E-22,031220
     5 5.1E-22,3.9E-22,2.5E-22,1.3E-22,1.0E-22,7.3E-23,5.4E-23,3.4E-23,  031230
     6 2.5E-23,1.6E-23,1.1E-23,6.9E-24,1.1E-24,8.0E-25,0.,0./            031240
      DATA QN2O5/ 32*0.,4.7E-18,3.2E-18,2.0E-18,1.3E-18,9.5E-19,7.8E-19,031250
     26.0E-19,4.8E-19,3.7E-19,3.1E-19,2.5E-19,2.1E-19,1.7E-19,1.3E-19,  031260
     38.9E-20,5.1E-20,4.2E-20,3.3E-20,2.5E-20,1.9E-20,1.3E-20,1.03E-20, 031270
     47.5E-21,5.8E-21,4.0E-21,3.4E-21,2.7E-21,2.3E-21,1.8E-21,1.4E-21,  031280
     51.0E-21,7.4E-22,4.7E-22,3.0E-22,1.3E-22, 5*0./                     031290
C                                                                        031300
      DATA QHCL/19*0.,2.11E-18,2.81E-18,3.45E-18,3.82E-18,3.32E-18,      031310
     12.48E-18,1.63E-18,1.09E-18,5.80E-19,3.13E-19,1.45E-19,6.18E-20,    031320
     27.56E-20,9.83E-21,3.95E-21,1.37E-21,4.80E-22,37*0./                031330
      DATA QHOCL/49*0.,6.3E-20,7.9E-20,9.5E-20,1.05E-19,1.15E-19,        031340
     11.25E-19,1.35E-19,1.27E-19,1.19E-19,1.07E-19,9.5E-20,8.8E-20,      031350
     27.30E-20,6.35E-20,4.80E-20,3.80E-20,2.50E-20,2.6E-20,2.4E-20,      031360
     32.00E-20,1.60E-20,1.20E-20,4.80E-20/                               031370
      DATA QH2O/8*0.,5.0E-18,4.0E-18,3.0E-18,4.0E-18,5.0E-18,4.0E-18,    031380
     11.4E-17,6.0E-18,7.0E-18,3.2E-18,7.0E-19,5.0E-19,1.0E-18,2.2E-18,   031390
     23.5E-18,4.8E-18,4.3E-18,2.8E-18,7.5E-19,5.0E-20,5.2E-21,6.3E-22,   031400
     36.3E-23,41*0./                                                     031410
      DATA QNO2/49*0.,6.77E-20,8.52E-20,1.09E-19,1.67E-19,               031420
     11.83E-19,2.19E-19,2.35E-19,2.54E-19,2.91E-19,3.14E-19,             031430
     23.23E-19,3.43E-19,3.11E-19,4.37E-19,3.90E-19,5.37E-19,             031440
     34.37E-19,5.00E-19,5.93E-19,5.79E-19,5.49E-19,5.62E-19,             031450
     46.56E-19,8.66E-19/                                                 031460
C                                                                        031470
      DATA CLX/1.1E-9,5.7E-10,3.1E-10,1.7E-10,1.2E-10,8.4E-11,1.1E-10,   031480
     11.3E-10,2.4E-10,6.0E-10,9.5E-10,1.3E-9,1.6E-9,1.8E-9,2.0E-9,       031490
     22.2E- 9,2.3E- 9,2.3E- 9,2.4E-9,2.4E-9,2.4E-9,2.4E-9,2.4E-9,        031500
     32.4E- 9,2.4E- 9,2.4E- 9,2.4E-9,2.4E-9,2.4E-9,2.4E-9,2.4E-9,        031510
     42.4E- 9,2.4E- 9,2.4E- 9,2.4E-9,2.4E-9,2.4E-9,2.4E-9,2.4E-9,        031520
     52.4E- 9,2.4E- 9/                                                   031530
C     - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -    031540
      DATA DA23/2.828E03,5.371E02,1.192E02,6.337E01,6.069E01,            031550
     1 5.675E01,5.585E01,5.048E01,4.511E01,4.314E01,2.667E01,1.4555E01,  031560
     2 8.826E00,5.706E00,3.574E00,2.238E00,1.148E00,8.223E-01,4.219E-01, 031570
     3 3.022E-01,1.550E-01,7.960E-02,5.704E-02,2.929E-02,2.099E-02,      031580
     4 1.078E-02,5.580E-03,4.014E-03,2.078E-03,1.495E-03,7.735E-04,      031590
     5 4.003E-04,2.880E-04,1.490E-04,1.072E-04,5.550E-05,2.144E-05,      031600
     6 1.332E-05,5.144E-06,3.196E-06,1.234E-06/                          031610
C                                                                        031620
      END                                                                031630
LIBRARY(LIB,NEW)                                                         031650
ADD(*,MAIN,AL=1)                                                         031660
ADD(*,LGO)                                                               031670
FINISH.                                                                  031680
ENDRUN.                                                                  031690


**********        DXDXIDX  //// END OF LIST ////
**********        DXDXIDX  //// END OF LIST ////
```

APPENDIX B

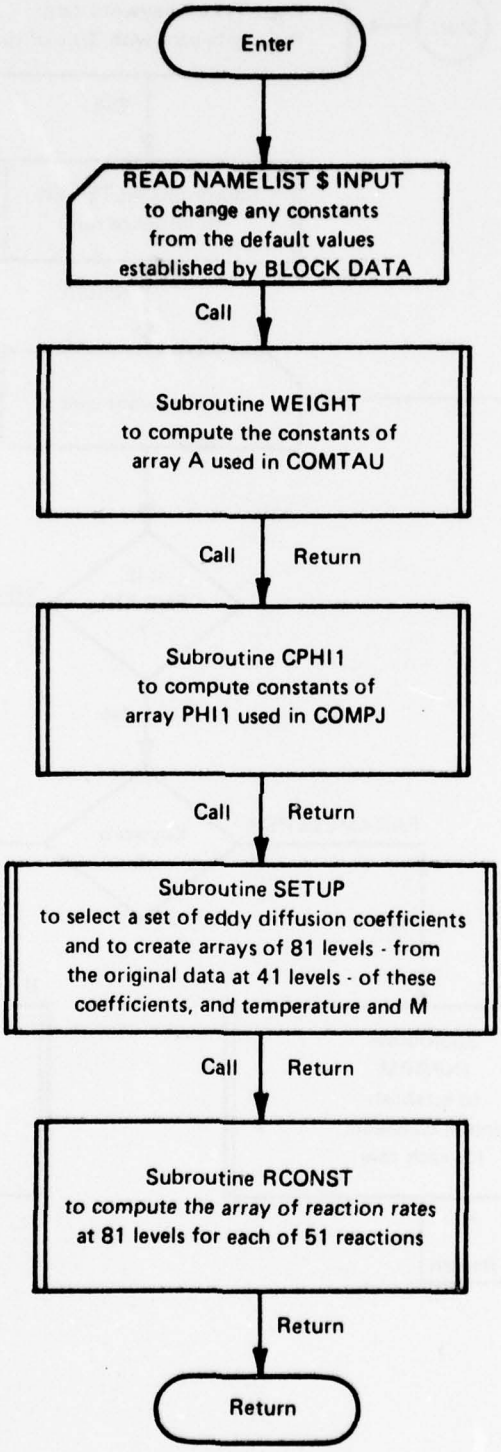
FLOW CHARTS

CMSP Chlorine Model Study Program



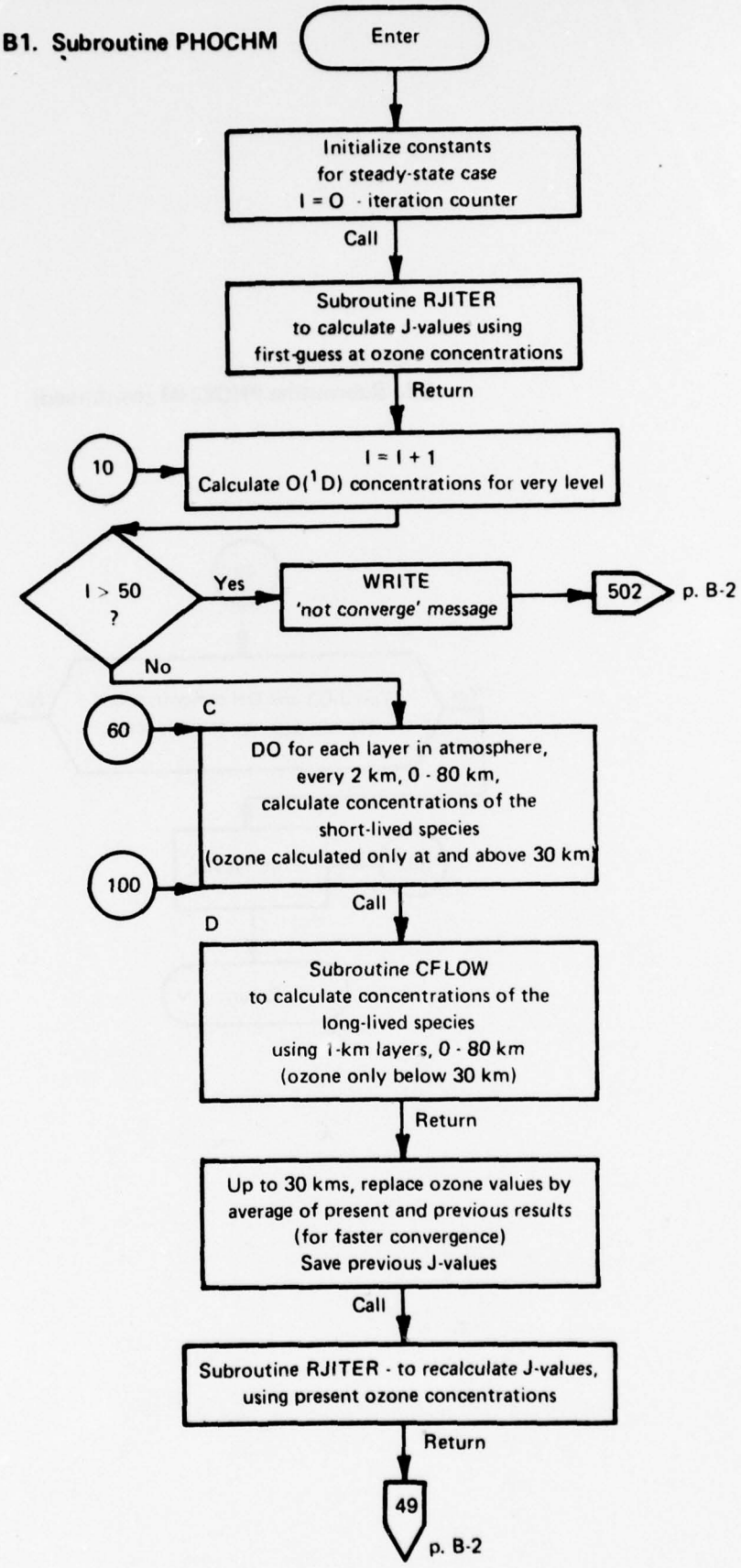
70904

A. Subroutine INPARM



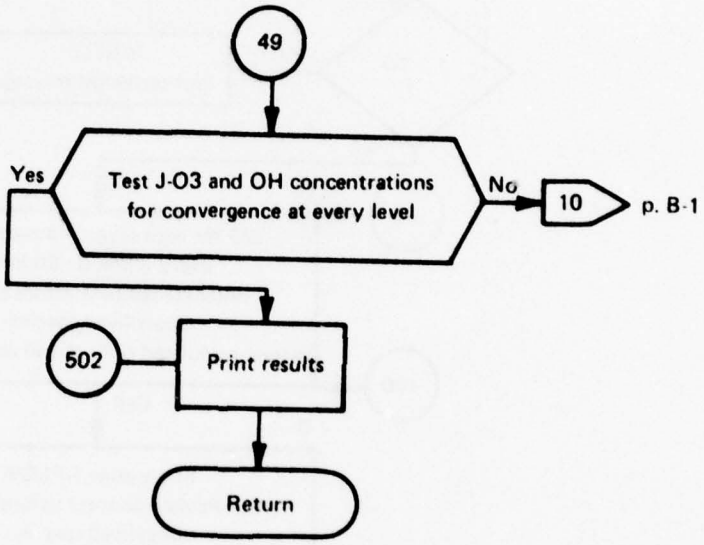
709022

B1. Subroutine PHOCHM



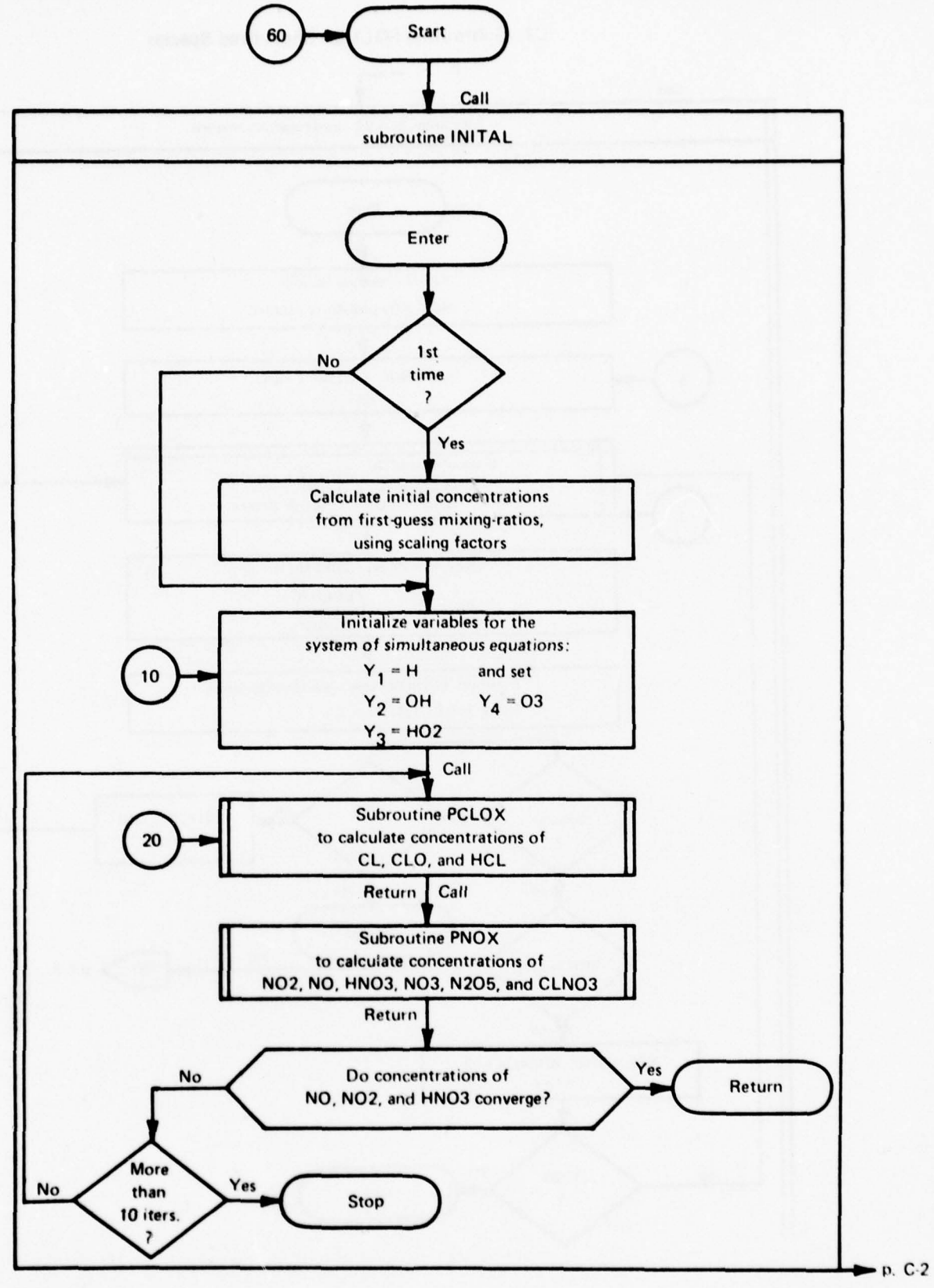
709023

B2. Subroutine PHOCHM (continued)

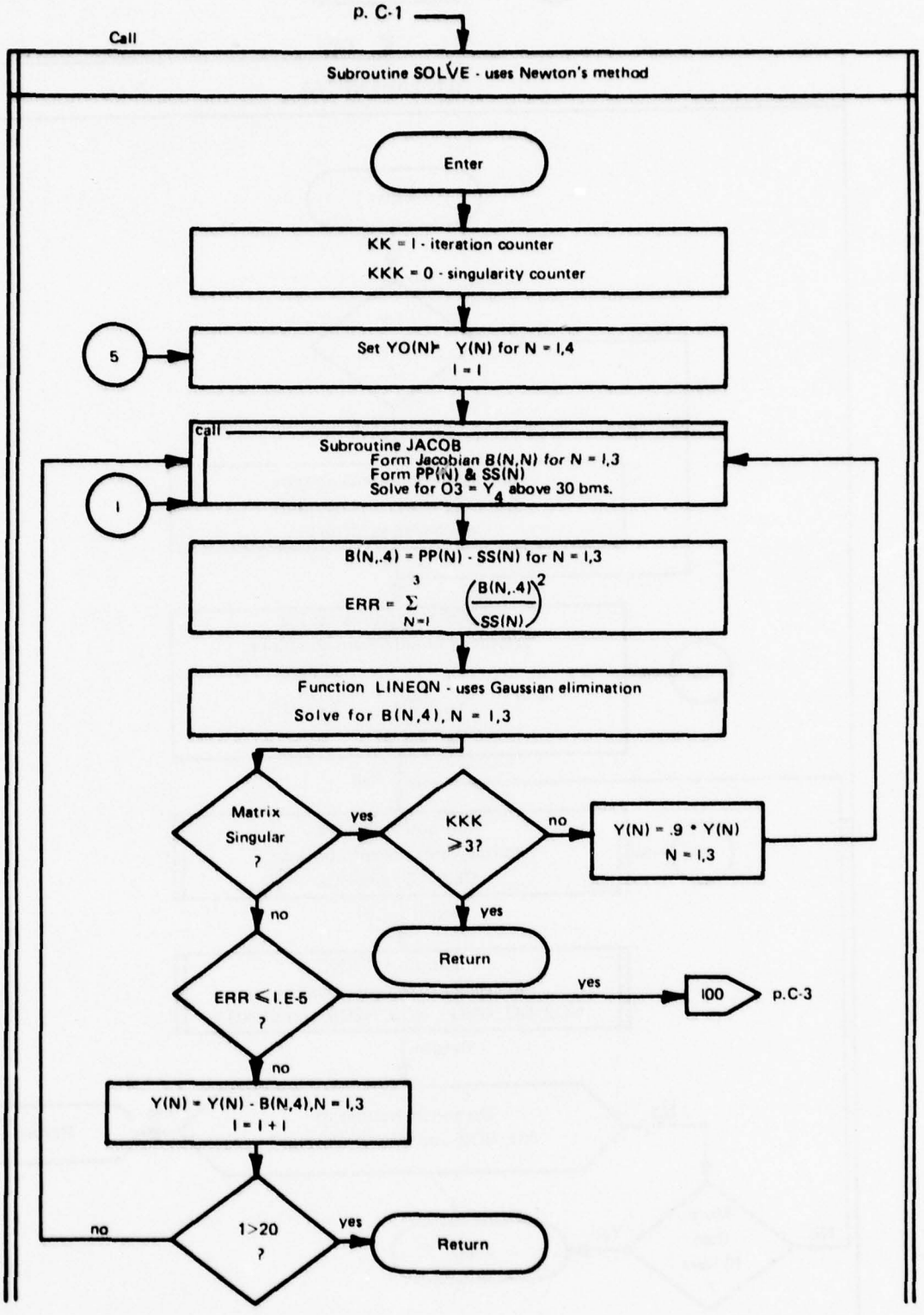


709224

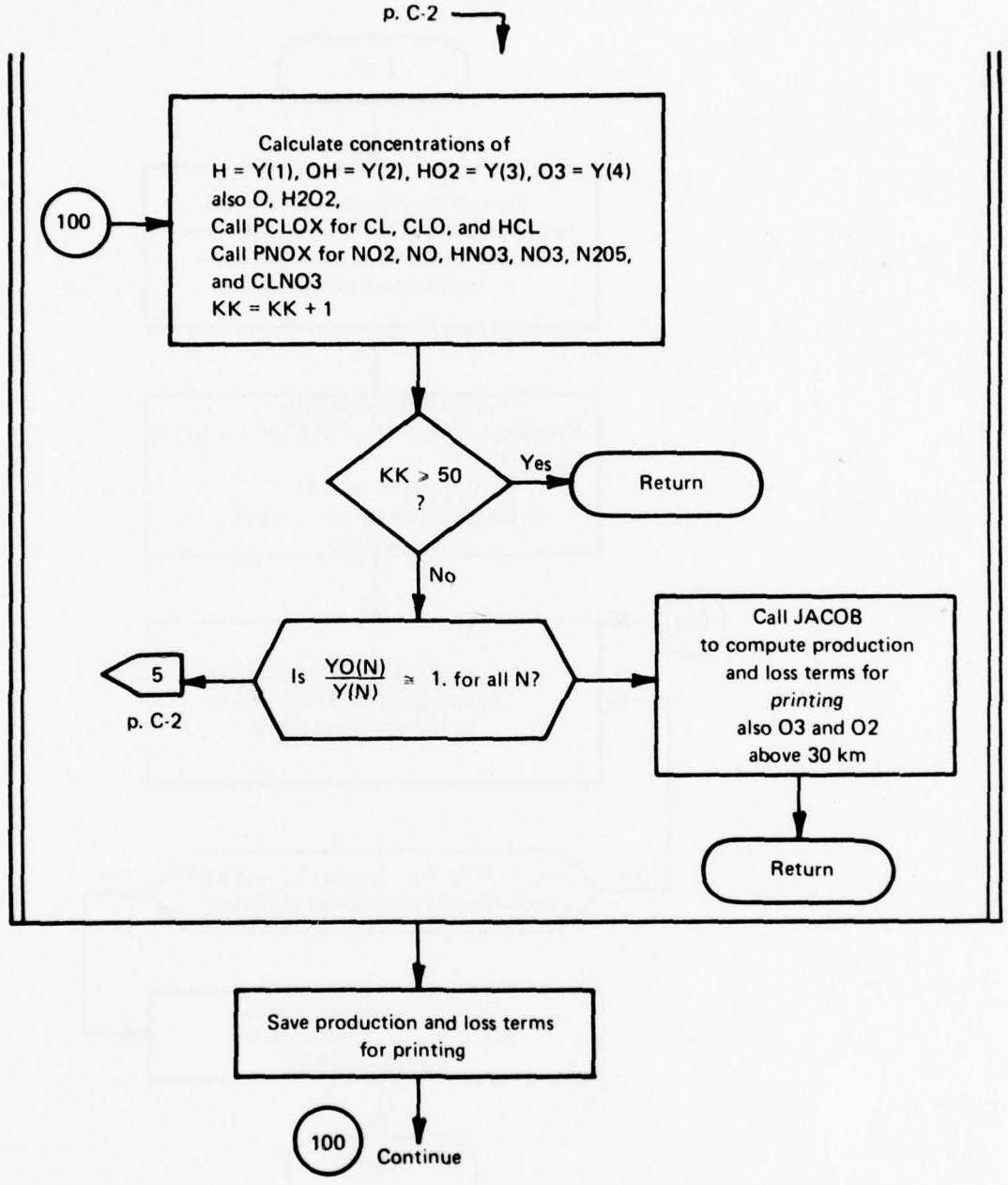
C1. Subroutine INITAL - Short-lived Species



C2. Subroutine SOLVE - Short-lived Species

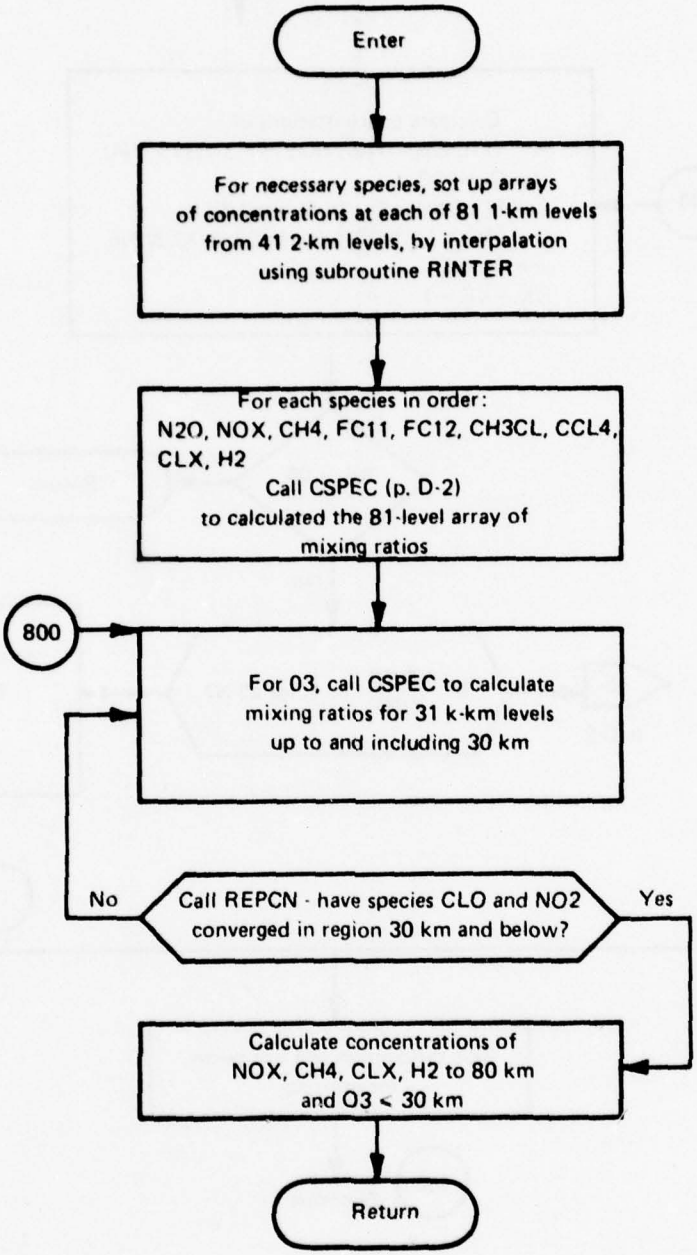


C3. Subroutine SOLVE (continued)

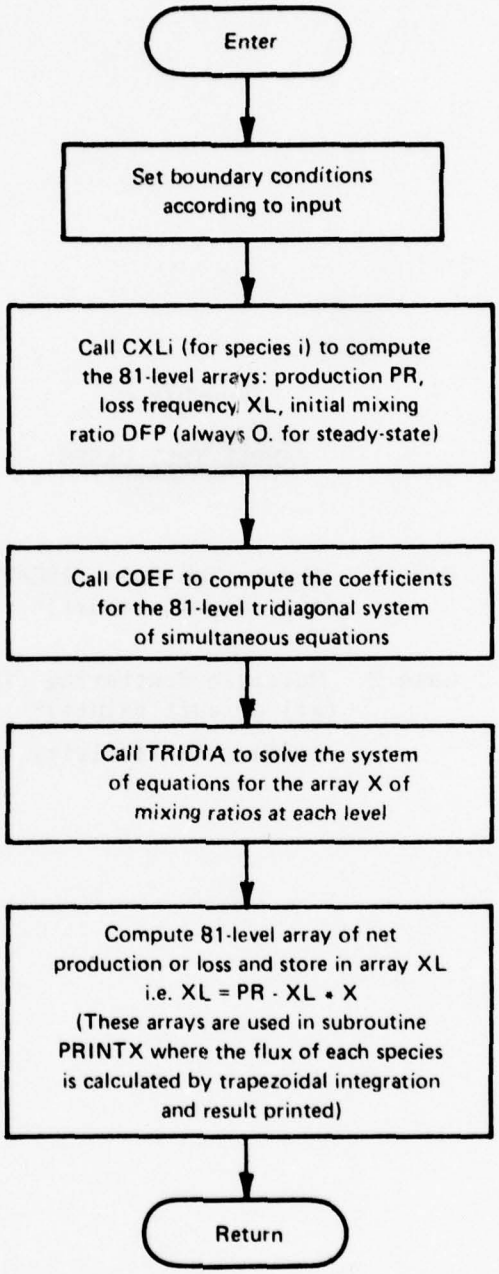


709028

D1. Subroutine CFLOW - Long-lived Species



D2. Subroutine CSPEC



709026

APPENDIX C

SAMPLE TEST CASES

Case 1 Absorption Only (ISCATT = 0)
(all default values)*

Case 2 Multiple Scattering (ISCATT = 1)
(all default values)*
Surface Reflectivity = 0.2

*Exceptions: ISWITCH = 0 (fixed sun angle)
RF11 = 8.30 E + 05
RF12 = 1.13 E + 06

LAST ITERATION = 9

ALT	CJO2	CJO3	CJCF2	CJCF3	CJO31	PREVO3	DOSINT	DMINT	PREVOH
0.	7.677E-35	7.741E-05	1.436E-32	6.171E-31	7.737E-06	7.729E+11	5.922E+18	2.194E+25	7.519E+06
200000.	3.911E-31	3.732E-05	1.136E-28	7.716E-27	6.931E-06	5.953E+11	8.790E+18	1.743E+25	2.321E+06
400000.	5.438E-28	3.854E-05	2.345E-25	6.558E-24	6.257E-06	4.352E+11	9.682E+18	1.367E+25	1.839E+06
600000.	3.169E-25	3.832E-05	1.955E-22	4.347E-21	5.459E-06	4.302E+11	8.590E+18	1.008E+25	1.367E+06
800000.	3.323E-23	3.307E-05	3.501E-20	1.407E-18	8.665E-06	4.170E+11	8.504E+18	8.253E+24	7.973E+05
1000000.	1.231E-20	3.944E-05	2.121E-17	2.769E-15	8.372E-06	4.642E+11	8.416E+18	6.292E+24	4.725E+05
1200000.	3.066E-19	3.900E-05	1.323E-15	2.720E-14	9.179E-06	5.981E+11	8.310E+18	4.727E+24	3.030E+05
1400000.	3.480E-17	4.055E-05	3.024E-14	1.326E-12	9.477E-06	7.080E+11	8.174E+18	3.443E+24	1.526E+05
1600000.	7.231E-16	4.157E-05	2.177E-12	2.316E-11	1.007E-05	1.477E+12	7.950E+18	2.433E+24	2.912E+05
1800000.	7.459E-15	4.395E-05	2.515E-11	2.526E-10	1.153E-05	3.347E+12	7.468E+18	1.747E+24	5.370E+05
2000000.	4.966E-14	4.957E-05	1.335E-10	1.754E-09	1.448E-05	4.437E+12	6.690E+18	1.254E+24	7.530E+05
2200000.	2.418E-13	5.551E-05	9.222E-10	6.543E-09	1.947E-05	5.076E+12	5.739E+18	9.213E+23	1.001E+06
2400000.	3.447E-13	6.591E-05	3.370E-09	3.237E-08	2.731E-05	5.388E+12	4.692E+18	6.752E+23	1.352E+06
2600000.	3.077E-12	3.417E-15	1.197E-08	1.049E-07	4.185E-05	5.234E+12	3.630E+18	4.975E+23	1.869E+06
2800000.	9.659E-12	1.115E-14	3.243E-08	2.805E-07	6.591E-05	4.606E+12	2.040E+18	3.539E+23	2.690E+06
3000000.	2.106E-11	[illegible]	7.343E-08	6.319E-07	1.089E-04	7.724E+12	1.801E+18	2.750E+23	4.050E+06
3200000.	4.470E-11	[illegible]	1.750E-07	1.195E-06	1.812E-04	2.750E+12	1.159E+18	2.050E+23	6.194E+06
3400000.	8.129E-11	7.593E-04	[illegible]	1.936E-06	3.024E-04	1.751E+12	7.125E+17	1.592E+23	9.265E+06
3600000.	1.311E-10	[illegible]	3.314E-07	2.717E-06	4.935E-04	1.077E+12	4.292E+17	1.176E+23	1.322E+07
3800000.	1.692E-10	9.583E-04	3.747E-07	3.423E-06	8.173E-04	5.220E+11	2.597E+17	8.956E+22	1.769E+07
4000000.	2.467E-10	1.349E-03	4.345E-07	3.994E-06	1.242E-03	3.601E+11	1.615E+17	6.958E+22	2.124E+07
4200000.	2.978E-10	1.973E-03	4.875E-07	4.433E-06	1.875E-03	2.189E+11	1.036E+17	5.279E+22	2.261E+07
4400000.	3.434E-10	[illegible]	5.135E-07	4.758E-06	2.468E-03	1.390E+11	6.782E+16	4.033E+22	2.204E+07
4600000.	3.752E-10	[illegible]	5.435E-07	5.027E-06	2.924E-03	3.904E+10	4.503E+16	3.173E+22	2.019E+07
4800000.	4.047E-10	3.475E-03	5.785E-07	5.237E-06	3.417E-03	5.780E+10	3.035E+16	2.475E+22	1.773E+07
5000000.	4.334E-10	[illegible]	[illegible]	5.423E-06	3.733E-03	3.874E+10	2.069E+16	1.934E+22	1.595E+07
5200000.	4.665E-10	[illegible]	6.519E-07	[illegible]	3.977E-03	2.602E+10	1.422E+16	1.511E+22	1.345E+07
5400000.	5.098E-10	[illegible]	[illegible]	6.598E-06	4.150E-03	1.808E+10	9.908E+15	1.179E+22	1.179E+07
5600000.	5.677E-10	4.332E-03	[illegible]	[illegible]	4.275E-03	1.221E+10	6.779E+15	9.151E+21	1.048E+07
5800000.	5.320E-10	4.425E-03	[illegible]	6.282E-06	4.353E-03	8.207E+09	4.732E+15	7.082E+21	9.158E+06
6000000.	7.417E-10	[illegible]	[illegible]	6.946E-06	4.423E-03	5.576E+09	3.349E+15	5.457E+21	7.389E+06
6200000.	[illegible]	4.523E-03	1.024E-06	6.817E-06	4.456E-03	4.106E+09	2.380E+15	4.179E+21	6.651E+06
6400000.	3.976E-10	4.558E-03	[illegible]	7.082E-06	4.493E-03	3.050E+09	1.665E+15	3.174E+21	5.367E+06
6600000.	[illegible]	4.579E-03	1.195E-06	7.370E-06	4.522E-03	2.180E+09	1.142E+15	2.789E+21	4.461E+06
6800000.	1.175E-09	[illegible]	[illegible]	7.592E-06	4.533E-03	[illegible]	7.798E+14	1.779E+21	4.093E+06
7000000.	1.417E-09	[illegible]	1.334E-06	7.744E-06	4.549E-03	8.672E+08	5.490E+14	1.719E+21	4.078E+06
7200000.	1.762E-09	4.613E-03	1.353E-06	7.903E-06	4.556E-03	6.123E+08	4.011E+14	9.540E+20	3.543E+06
7400000.	[illegible]	[illegible]	1.471E-06	[illegible]	4.561E-03	4.047E+08	2.974E+14	6.853E+20	3.103E+06
7600000.	[illegible]	4.621E-03	1.455E-06	9.132E-06	4.564E-03	3.347E+08	2.214E+14	4.945E+20	2.346E+06
7800000.	3.298E-09	4.624E-03	1.491E-06	9.209E-06	4.567E-03	2.737E+08	1.606E+14	3.362E+20	1.567E+06
8000000.	3.829E-09	4.627E-03	1.511E-06	9.267E-06	4.570E-03	2.220E+08	1.110E+14	2.279E+20	1.012E+06

LAST ITERATION = 9

ALT	CJCLO3	CJN2O	CJHNO3	CJH2O2	CJN2O5	CJCCL4	CJCH3CL
0.	3.669E-05	2.477E-32	1.941E-07	1.602E-06	1.406E-05	3.265E-30	1.979E-33
200000.	3.682E-05	1.459E-28	1.374E-07	1.614E-06	1.413E-05	1.775E-26	1.320E-29
400000.	3.693E-05	2.510E-25	2.001E-07	1.623E-06	1.419E-05	7.000E-23	2.597E-26
600000.	3.702E-05	1.600E-22	2.025E-07	1.631E-06	1.423E-05	1.544E-20	2.022E-23
800000.	3.711E-05	5.940E-20	2.048E-07	1.639E-06	1.427E-05	4.360E-15	9.739E-21
1000000.	3.720E-05	1.157E-17	2.071E-07	1.647E-06	1.432E-05	6.852E-16	2.203E-18
1200000.	3.732E-05	9.868E-15	2.101E-07	1.657E-06	1.437E-05	5.091E-14	2.040E-16
1400000.	3.746E-05	4.424E-14	2.139E-07	1.670E-06	1.444E-05	2.054E-12	9.702E-15
1600000.	3.771E-05	1.013E-12	2.207E-07	1.692E-06	1.457E-05	4.292E-11	2.357E-13
1800000.	3.629E-05	1.131E-11	2.351E-07	1.744E-06	1.483E-05	4.405E-10	2.730E-12
2000000.	3.935E-05	7.873E-11	2.788E-07	1.839E-06	1.537E-05	2.902E-09	1.964E-11
2200000.	4.095E-05	3.314E-10	3.712E-07	1.985E-06	1.624E-05	1.395E-08	1.006E-10
2400000.	4.333E-05	1.513E-09	6.347E-07	2.211E-06	1.728E-05	5.379E-08	4.021E-10
2600000.	4.704E-05	4.947E-09	1.239E-06	2.570E-06	1.911E-05	1.714E-07	1.319E-09
2800000.	5.315E-05	1.296E-08	2.777E-06	3.066E-06	2.236E-05	4.719E-07	3.602E-09
3000000.	6.359E-05	2.913E-08	5.535E-06	4.298E-06	2.848E-05	1.118E-06	9.184E-09
3200000.	8.137E-05	3.507E-08	1.014E-05	5.124E-06	3.945E-05	2.268E-06	1.546E-08
3400000.	1.097E-04	8.575E-08	1.550E-05	8.924E-06	5.503E-05	3.940E-06	2.465E-08
3600000.	1.563E-04	1.241E-07	2.223E-05	1.277E-05	7.999E-05	5.895E-06	3.412E-08
3800000.	2.024E-04	1.561E-07	2.877E-05	1.706E-05	1.079E-04	7.765E-06	4.259E-08
4000000.	2.614E-04	1.823E-07	3.353E-05	2.314E-05	1.385E-04	9.390E-06	4.951E-08
4200000.	3.204E-04	2.027E-07	3.852E-05	2.979E-05	1.689E-04	1.047E-05	5.490E-08
4400000.	3.737E-04	2.183E-07	4.240E-05	3.400E-05	1.953E-04	1.134E-05	5.937E-08
4600000.	4.180E-04	2.305E-07	4.549E-05	3.830E-05	2.192E-04	1.199E-05	6.318E-08
4800000.	4.524E-04	2.404E-07	4.768E-05	4.182E-05	2.363E-04	1.248E-05	6.714E-08
5000000.	4.784E-04	2.492E-07	4.970E-05	4.442E-05	2.502E-04	1.286E-05	7.213E-08
5200000.	4.970E-04	2.580E-07	5.112E-05	4.655E-05	2.600E-04	1.324E-05	7.897E-08
5400000.	5.108E-04	2.675E-07	5.220E-05	4.790E-05	2.672E-04	1.358E-05	8.819E-08
5600000.	5.209E-04	2.782E-07	5.332E-05	4.888E-05	2.724E-04	1.392E-05	9.987E-08
5800000.	5.282E-04	2.902E-07	5.430E-05	4.968E-05	2.760E-04	1.427E-05	1.136E-07
6000000.	5.334E-04	3.031E-07	5.527E-05	5.028E-05	2.786E-04	1.462E-05	1.287E-07
6200000.	5.373E-04	3.165E-07	5.625E-05	5.075E-05	2.802E-04	1.496E-05	1.443E-07
6400000.	5.405E-04	3.298E-07	5.723E-05	5.114E-05	2.813E-04	1.528E-05	1.600E-07
6600000.	5.429E-04	3.429E-07	5.316E-05	5.145E-05	2.829E-04	1.557E-05	1.759E-07
6800000.	5.447E-04	3.563E-07	5.300E-05	5.171E-05	2.836E-04	1.583E-05	1.931E-07
7000000.	5.460E-04	3.747E-07	5.374E-05	5.192E-05	2.841E-04	1.605E-05	2.128E-07
7200000.	5.470E-04	4.005E-07	5.035E-05	5.211E-05	2.843E-04	1.623E-05	2.357E-07
7400000.	5.477E-04	4.376E-07	5.097E-05	5.229E-05	2.947E-04	1.637E-05	2.611E-07
7600000.	5.482E-04	4.863E-07	5.127E-05	5.245E-05	2.349E-04	1.648E-05	2.872E-07
7800000.	5.487E-04	5.430E-07	5.155E-05	5.260E-05	2.850E-04	1.657E-05	3.122E-07
8000000.	5.490E-04	6.010E-07	5.182E-05	5.273E-05	2.851E-04	1.665E-05	3.344E-07

LAST ITERATION = 1

ALT	CJO2	CJO3	CJOEX	CJOEX	CJO31	PREVO2	JO2INT	O4INT	PREVOH
0.	7.785E-25	3.743E-07	1.484E-32	5.210E-31	7.772E-06	7.231E+11	8.915E+18	2.134E+25	3.519E+06
20000.	3.955E-31	3.794E-05	1.155E-26	7.754E-27	8.146E-06	5.052E+11	8.783E+18	1.747E+25	2.321E+06
40000.	6.505E-28	3.837E-05	2.733E-25	5.762E-24	8.273E-06	4.050E+11	8.657E+18	1.457E+25	1.939E+06
60000.	3.199E-25	3.875E-05	1.379E-23	4.481E-21	8.385E-06	4.390E+11	8.582E+18	1.358E+25	1.767E+06
80000.	3.382E-23	3.911E-05	1.476E-22	1.476E-19	8.491E-06	4.169E+11	8.497E+18	8.233E+24	7.978E+05
100000.	1.237E-20	3.947E-05	5.133E-17	2.798E-18	8.899E-06	4.643E+11	8.409E+18	6.292E+24	4.720E+05
120000.	3.847E-19	3.983E-05	1.381E-15	2.709E-14	9.149E-06	5.079E+11	8.302E+18	4.727E+24	3.036E+05
140000.	3.449E-17	4.053E-05	9.357E-14	2.038E-12	9.491E-06	7.577E+11	8.167E+18	3.443E+24	1.626E+05
150000.	7.265E-16	4.101E-05	2.154E-12	2.724E-11	1.039E-05	1.473E+12	7.944E+18	2.439E+24	2.912E+05
180000.	7.483E-15	4.299E-05	2.222E-11	2.533E-10	1.155E-05	3.747E+12	7.462E+18	1.747E+24	5.370E+05
200000.	4.587E-14	4.86AE-05	1.811E-10	2.709E-09	1.451E-05	4.433E+12	6.685E+18	1.254E+24	7.530E+05
220000.	2.42AE-13	5.459E-05	9.249E-10	8.262E-09	1.950E-05	5.072E+12	5.734E+18	9.217E+23	1.001E+06
240000.	9.423E-13	6.699E-05	3.579E-09	2.703E-08	2.734E-05	5.384E+12	4.689E+18	6.732E+23	1.352E+06
260000.	3.086E-12	8.419E-05	1.133E-08	1.542E-07	4.190E-05	5.931E+12	3.627E+18	4.970E+23	1.869E+06
280000.	8.67AE-12	1.115E-04	3.259E-08	5.089E-07	6.599E-05	6.535E+12	2.638E+18	3.699E+23	2.630E+06
300000.	2.109E-11	1.568E-04	7.830E-08	5.320E-07	1.081E-04	8.726E+12	1.794E+18	2.705E+23	4.050E+06
320000.	4.474E-11	2.363E-04	1.931E-07	1.200E-06	1.814E-04	1.697E+13	1.158E+18	2.056E+23	6.194E+06
340000.	8.126E-11	3.864E-04	3.185E-07	2.905E-06	3.026E-04	1.759E+13	7.120E+17	1.552E+23	9.765E+06
360000.	1.313E-10	5.803E-04	5.011E-07	2.710E-06	4.958E-04	1.672E+13	4.294E+17	1.175E+23	1.392E+07
380000.	1.892E-10	8.693E-04	7.247E-07	5.424E-06	8.176E-04	5.216E+13	2.598E+17	8.953E+22	1.769E+07
400000.	2.463E-10	1.243E-03	9.394E-07	7.994E-06	1.283E-03	3.999E+13	1.615E+17	6.858E+22	2.124E+07
420000.	2.973E-10	1.683E-03	1.113E-06	1.036E-05	1.876E-03	2.188E+13	1.036E+17	5.278E+22	2.261E+07
440000.	3.404E-10	2.325E-03	1.253E-06	1.176E-05	2.458E-03	1.788E+13	6.781E+16	4.083E+22	2.204E+07
460000.	3.752E-10	3.051E-03	1.434E-06	1.367E-05	2.994E-03	8.903E+13	4.503E+16	3.173E+22	2.019E+07
480000.	4.047E-10	3.477E-03	1.738E-06	1.637E-05	3.417E-03	5.780E+13	3.035E+16	2.475E+22	1.773E+07
500000.	4.374E-10	3.709E-03	2.111E-06	1.963E-05	3.738E-03	3.834E+13	2.069E+16	1.934E+22	1.555E+07
520000.	4.665E-10	3.933E-03	2.513E-06	2.308E-05	3.977E-03	2.602E+13	1.422E+16	1.511E+22	1.345E+07
540000.	5.088E-10	4.207E-03	2.947E-06	2.720E-05	4.153E-03	1.808E+13	9.808E+15	1.178E+22	1.178E+07
560000.	5.637E-10	4.577E-03	3.770E-06	3.033E-05	4.275E-03	1.221E+13	6.779E+15	9.151E+21	1.048E+07
580000.	6.329E-10	4.942E-03	4.433E-06	3.282E-05	4.367E-03	8.257E+09	4.732E+15	7.082E+21	9.158E+06
600000.	7.117E-10	4.408E-03	5.343E-06	3.546E-05	4.423E-03	5.576E+09	3.349E+15	5.457E+21	7.989E+06
620000.	8.000E-10	4.823E-03	6.394E-06	3.817E-05	4.466E-03	3.810E+09	2.381E+15	4.179E+21	6.651E+06
640000.	8.970E-10	5.255E-03	1.112E-06	7.062E-05	4.498E-03	3.050E+09	1.666E+15	3.174E+21	5.369E+06
660000.	1.015E-09	4.579E-03	1.135E-06	7.330E-05	4.522E-03	2.180E+09	1.146E+15	2.389E+21	4.461E+06
680000.	1.176E-09	4.595E-03	1.271E-06	7.592E-05	4.533E-03	1.441E+09	7.798E+14	1.779E+21	4.093E+06
700000.	1.417E-09	4.606E-03	1.374E-06	7.744E-05	4.543E-03	8.672E+08	5.490E+14	1.310E+21	4.078E+06
720000.	1.702E-09	4.617E-03	1.483E-06	7.963E-05	4.555E-03	6.123E+08	4.011E+14	9.540E+20	3.543E+06
740000.	2.214E-09	4.618E-03	1.471E-06	8.031E-05	4.561E-03	4.247E+08	2.974E+14	6.853E+20	3.103E+06
760000.	2.742E-09	4.624E-03	1.455E-06	8.132E-05	4.564E-03	3.347E+08	2.214E+14	4.845E+20	2.705E+06
780000.	3.298E-09	4.624E-03	1.491E-06	8.295E-05	4.567E-03	2.737E+08	1.606E+14	3.352E+20	1.567E+06
800000.	3.869E-09	4.627E-03	1.511E-06	8.257E-05	4.571E-03	2.220E+08	1.110E+14	2.478E+20	1.012E+06

LAST ITERATION 4

ALT	CJCLO?	CJN2O	CJHNO3	CJH2O2	CJN2O5	CJCCL4	CJCH3CL
0.	3.676E-05	2.365E-32	1.943E-07	1.697E-06	1.417E-05	3.269E-30	2.007E-33
200000.	3.653E-05	1.477E-28	1.376E-07	1.614E-06	1.413E-05	1.795E-26	1.335E-29
400000.	3.697E-05	2.607E-25	2.035E-07	1.624E-06	1.419E-05	3.032E-23	2.623E-26
600000.	3.707E-05	1.014E-22	2.127E-07	1.632E-06	1.423E-05	1.556E-21	2.037E-23
800000.	3.712E-05	5.577E-20	2.042E-07	1.640E-06	1.428E-05	4.391E-19	9.792E-21
1000000.	3.721E-05	1.167E-17	2.073E-07	1.649E-06	1.432E-05	6.889E-16	2.213E-18
1200000.	3.732E-05	3.303E-16	2.135E-07	1.658E-06	1.438E-05	5.115E-14	2.046E-16
1400000.	3.747E-05	4.441E-14	2.141E-07	1.671E-06	1.445E-05	2.052E-12	9.737E-15
1600000.	3.772E-05	1.022E-12	2.293E-07	1.693E-06	1.457E-05	4.319E-11	2.364E-13
1800000.	3.830E-05	1.175E-11	2.352E-07	1.744E-06	1.485E-05	4.419E-10	2.778E-12
2000000.	3.936E-05	7.593E-11	2.721E-07	1.839E-06	1.537E-05	2.910E-09	1.962E-11
2200000.	4.096E-05	3.927E-10	3.775E-07	1.966E-06	1.514E-05	1.398E-08	1.008E-10
2400000.	4.334E-05	1.525E-09	5.355E-07	2.212E-06	1.723E-05	5.349E-08	4.028E-10
2600000.	4.705E-05	4.837E-09	1.232E-06	2.579E-06	1.912E-05	1.717E-07	1.321E-09
2800000.	5.316E-05	1.293E-08	3.751E-06	3.208E-06	2.237E-05	4.727E-07	3.606E-09
3000000.	6.362E-05	2.913E-08	5.547E-06	4.001E-06	2.850E-05	1.219E-06	8.192E-09
3200000.	8.136E-05	5.515E-08	1.013E-05	6.128E-06	3.948E-05	2.270E-06	1.547E-08
3400000.	1.097E-04	5.633E-08	1.537E-05	9.926E-06	5.672E-05	3.942E-06	2.465E-08
3600000.	1.563E-04	1.246E-07	2.228E-05	1.277E-05	7.392E-05	5.396E-06	3.413E-08
3800000.	2.124E-04	1.501E-07	2.837E-05	1.756E-05	1.073E-04	7.706E-06	4.259E-08
4000000.	2.645E-04	1.823E-07	3.393E-05	2.314E-05	1.395E-04	9.306E-06	4.951E-08
4200000.	3.204E-04	2.007E-07	3.852E-05	2.681E-05	1.583E-04	1.047E-05	5.498E-08
4400000.	3.737E-04	2.163E-07	4.205E-05	3.400E-05	1.963E-04	1.134E-05	5.937E-08
4600000.	4.183E-04	2.305E-07	4.549E-05	3.838E-05	2.192E-04	1.199E-05	6.318E-08
4800000.	4.524E-04	2.404E-07	4.756E-05	4.182E-05	2.359E-04	1.248E-05	6.714E-08
5000000.	4.781E-04	2.492E-07	4.970E-05	4.442E-05	2.502E-04	1.288E-05	7.213E-08
5200000.	4.970E-04	2.586E-07	5.112E-05	4.655E-05	2.610E-04	1.324E-05	7.897E-08
5400000.	5.108E-04	2.673E-07	5.229E-05	4.786E-05	2.672E-04	1.358E-05	8.819E-08
5600000.	5.203E-04	2.792E-07	5.332E-05	4.888E-05	2.724E-04	1.392E-05	9.987E-08
5800000.	5.282E-04	2.905E-07	5.437E-05	4.958E-05	2.763E-04	1.427E-05	1.136E-07
6000000.	5.334E-04	3.071E-07	5.527E-05	5.028E-05	2.795E-04	1.462E-05	1.287E-07
6200000.	5.373E-04	3.165E-07	5.525E-05	5.075E-05	2.805E-04	1.496E-05	1.447E-07
6400000.	5.405E-04	3.291E-07	5.723E-05	5.114E-05	2.819E-04	1.528E-05	1.600E-07
6600000.	5.429E-04	3.422E-07	5.816E-05	5.145E-05	2.829E-04	1.557E-05	1.759E-07
6800000.	5.447E-04	3.563E-07	5.900E-05	5.171E-05	2.835E-04	1.583E-05	1.931E-07
7000000.	5.460E-04	3.747E-07	5.974E-05	5.192E-05	2.841E-04	1.605E-05	2.126E-07
7200000.	5.470E-04	4.005E-07	6.036E-05	5.211E-05	2.845E-04	1.623E-05	2.357E-07
7400000.	5.476E-04	4.378E-07	6.087E-05	5.229E-05	2.847E-04	1.637E-05	2.611E-07
7600000.	5.482E-04	4.865E-07	6.127E-05	5.245E-05	2.849E-04	1.648E-05	2.872E-07
7800000.	5.487E-04	5.436E-07	6.150E-05	5.260E-05	2.850E-04	1.657E-05	3.122E-07
8000000.	5.490E-04	6.019E-07	6.132E-05	5.277E-05	2.851E-04	1.665E-05	3.344E-07

K	ALT	H	OH	HO2	H2O2	O	O3	O3INT	O(D)
1	0.	4.0250E-01	7.5195E+06	1.1721E+09	1.0951E+11	2.2250E+03	7.2311E+11	8.9146E+18	8.1849E-03
2	200000.	2.4358E-01	2.7213E+06	7.9312E+08	1.1177E+11	2.2631E+03	5.9520E+11	8.7628E+18	7.8476E-03
3	400000.	2.0774E-01	1.3330E+06	7.9098E+08	6.5786E+10	2.7108E+03	4.8503E+11	8.5747E+18	8.2619E-03
4	600000.	1.5183E-01	1.3571E+06	4.4202E+08	3.6401E+10	3.4450E+03	4.3391E+11	8.5823E+18	9.2901E-03
5	800000.	5.5260E-02	7.9783E+05	2.6133E+08	1.4762E+10	4.4555E+03	4.1580E+11	8.4967E+18	1.0868E-02
6	1000000.	4.3577E-02	4.7233E+05	1.7396E+08	5.6790E+09	6.8342E+03	4.6406E+11	8.4087E+18	1.5054E-02
7	1200000.	3.0731E-02	3.3303E+05	1.1200E+08	2.0004E+09	1.2292E+04	5.9767E+11	8.3025E+18	2.4518E-02
8	1400000.	1.4961E-02	1.0213E+06	5.2067E+07	5.2520E+08	1.8267E+04	7.5770E+11	8.1069E+18	3.6409E-02
9	1600000.	2.3708E-02	2.3122E+05	5.3147E+07	9.6339E+08	6.7839E+04	1.4733E+12	7.9438E+18	1.0703E-01
10	1800000.	4.3680E-02	5.3704E+05	7.7034E+07	1.4107E+09	7.4656E+05	3.3433E+12	7.4621E+18	4.0786E-01
11	2000000.	5.5835E-02	7.0237E+05	9.0592E+07	1.8816E+09	9.8471E+05	4.4326E+12	6.6846E+18	9.6870E-01
12	2200000.	1.5561E-01	1.0013E+06	1.0462E+08	2.3626E+09	2.7891E+06	5.0716E+12	5.7341E+18	2.1070E+00
13	2400000.	3.0731E-01	1.7517E+06	1.1983E+08	2.7659E+09	5.2753E+06	5.3935E+12	4.6886E+18	4.4552E+00
14	2600000.	5.9760E-01	1.3558E+06	1.3007E+08	2.8013E+09	1.1068E+07	5.2306E+12	3.6272E+18	9.1208E+00
15	2800000.	1.7622E+00	2.3312E+06	1.3392E+08	2.3748E+09	2.1701E+07	4.6645E+12	2.6377E+18	1.7727E+01
16	3000000.	5.1510E+00	4.0439E+06	1.2755E+08	1.5970E+09	4.0154E+07	3.7136E+12	1.7993E+18	3.1918E+01
17	3200000.	1.7184E+01	6.1942E+06	1.0957E+08	8.2235E+08	6.8294E+07	2.6972E+12	1.1576E+18	5.3138E+01
18	3400000.	6.2993E+01	9.2547E+06	8.3755E+07	7.7351E+08	1.0570E+08	1.7587E+12	7.1201E+17	7.8998E+01
19	3600000.	2.0422E+02	1.3224E+07	5.9351E+07	1.2031E+08	1.7371E+08	1.0718E+12	4.2896E+17	1.0709E+02
20	3800000.	5.5057E+02	1.7536E+07	4.2114E+07	4.5472E+07	2.7065E+08	6.2155E+11	2.5962E+17	1.3760E+02
21	4000000.	2.8515E+03	2.1240E+07	3.1874E+07	2.0781E+07	4.1978E+08	3.5995E+11	1.6146E+17	1.6989E+02
22	4200000.	8.3168E+03	2.2579E+07	2.6146E+07	1.2026E+07	5.4146E+08	2.1894E+11	1.0358E+17	1.9994E+02
23	4400000.	2.1039E+04	2.2135E+07	2.2752E+07	8.0247E+06	9.7692E+08	1.3881E+11	6.7813E+16	2.2139E+02
24	4600000.	4.6062E+04	2.0132E+07	1.9141E+07	5.6146E+06	1.2755E+09	8.9029E+10	4.5030E+16	2.2727E+02
25	4800000.	8.7592E+04	1.7732E+07	1.6177E+07	3.9251E+06	1.6153E+09	5.7738E+10	3.0347E+16	2.1957E+02
26	5000000.	1.4843E+05	1.5525E+07	1.3643E+07	2.8100E+06	1.9284E+09	3.8736E+10	2.0694E+16	2.0601E+02
27	5200000.	2.7539E+05	1.3451E+07	1.1756E+07	1.9940E+06	2.2172E+09	2.6920E+10	1.4218E+16	1.8746E+02
28	5400000.	3.5468E+05	1.1777E+07	1.0127E+07	1.4377E+06	2.4931E+09	1.8078E+10	9.8081E+15	1.7088E+02
29	5600000.	5.5054E+05	1.0455E+07	8.9003E+06	1.0790E+06	2.7108E+09	1.2214E+10	6.7789E+15	1.5044E+02
30	5800000.	7.7806E+05	9.1583E+06	7.6781E+06	7.8500E+05	2.9778E+09	8.2369E+09	4.7316E+15	1.7095E+02
31	6000000.	1.1214E+06	7.9594E+06	6.6170E+06	5.6450E+05	7.1403E+09	5.5756E+09	3.3486E+15	1.1341E+02
32	6200000.	1.5765E+06	6.5512E+06	5.7812E+06	7.5544E+05	3.5370E+09	4.1051E+09	2.3804E+15	1.0556E+02
33	6400000.	2.0697E+06	5.7570E+06	4.2151E+06	2.0662E+05	4.0366E+09	3.0499E+09	1.6648E+15	9.9444E+01
34	6600000.	2.3379E+06	4.4533E+06	3.4068E+06	1.2691E+05	4.4704E+09	2.1796E+09	1.1418E+15	9.0540E+01
35	6800000.	4.0395E+06	4.0229E+06	3.0900E+06	9.7340E+04	4.5567E+09	1.4407E+09	7.7983E+14	7.6338E+01
36	7000000.	6.1351E+06	4.3779E+06	2.0901E+06	9.0146E+04	4.4178E+09	8.6722E+08	5.4904E+14	5.9545E+01
37	7200000.	7.2027E+06	3.5428E+06	2.5816E+06	5.8140E+04	4.9971E+09	5.1237E+08	4.0108E+14	5.4619E+01
38	7400000.	1.5934E+07	3.1130E+06	2.1572E+06	3.7594E+04	5.6266E+09	4.2469E+08	2.9738E+14	4.9598E+01
39	7600000.	1.3771E+07	2.7056E+06	1.4603E+06	1.5575E+04	7.7024E+09	3.3469E+08	2.2144E+14	5.1638E+01
40	7800000.	2.6231E+07	1.5582E+06	8.6073E+05	4.8976E+03	9.0796E+09	2.7373E+08	1.6060E+14	5.6323E+01
41	8000000.	3.2625E+07	1.0122E+06	4.6015E+05	1.2679E+03	1.7741E+10	2.2204E+08	1.1102E+14	6.1563E+01

K	ALT	NO	NO2	HNO3	NO3	N2O5	NOX
1	0.	5.9699E+08	4.5994E+09	5.9508E+10	4.4359E+06	6.2746E+08	4.4915E+10
2	2000.	5.1295E+08	3.9511E+09	1.8779E+10	1.1346E+06	7.3251E+07	2.1777E+10
3	4000.	3.3707E+08	4.2412E+09	5.9618E+09	6.8126E+05	7.7697E+06	9.7811E+09
4	5000.	2.7270E+08	3.1179E+09	1.3771E+09	8.7911E+04	1.9786E+06	4.8476E+09
5	8000.	2.2046E+08	4.2734E+09	2.4715E+09	3.7347E+04	7.0365E+05	2.8480E+09
6	10000.	2.7005E+08	1.1597E+09	1.5896E+09	1.7005E+04	1.2481E+05	1.9789E+09
7	12000.	3.5965E+08	1.2711E+09	2.7412E+09	1.5727E+04	1.5332E+05	2.2572E+09
8	14000.	4.4873E+08	2.8648E+08	4.7277E+09	1.4549E+04	2.1034E+05	2.6826E+09
9	15000.	5.1987E+08	3.3777E+08	7.8788E+09	2.2799E+04	3.9292E+05	4.6838E+09
10	16000.	5.8978E+08	4.1408E+08	9.5125E+09	1.1743E+04	3.4222E+06	9.8782E+09
11	17000.	7.4913E+08	5.4297E+08	1.4707E+10	4.0745E+05	9.7911E+06	1.2106E+10
12	18000.	2.9342E+09	2.7386E+09	1.2258E+10	5.1587E+05	2.3167E+07	1.2449E+10
13	20000.	3.6422E+09	1.7628E+09	9.0112E+09	7.2295E+05	5.2093E+07	1.1772E+10
14	25000.	5.4734E+08	1.7355E+08	6.8402E+09	1.0843E+06	1.2652E+08	1.0437E+10
15	28000.	5.8590E+08	2.8837E+08	4.5224E+09	2.4314E+06	1.7951E+08	8.8929E+09
16	30000.	6.2760E+08	3.2458E+08	3.7135E+09	2.5794E+06	1.4859E+08	7.6907E+09
17	32000.	1.0764E+09	4.7512E+08	4.9585E+09	2.4996E+06	7.2925E+07	5.7866E+09
18	34000.	1.4837E+09	7.4487E+08	9.5707E+09	1.7775E+06	2.3214E+07	4.4596E+09
19	36000.	1.6255E+09	1.0736E+09	1.4654E+10	7.3768E+05	5.4175E+06	7.3714E+09
20	38000.	1.7365E+09	1.2174E+09	2.0711E+10	3.2732E+05	9.7387E+05	2.5136E+09
21	40000.	1.6488E+09	1.3873E+09	3.1601E+09	1.2443E+05	1.2367E+05	1.8572E+09
22	42000.	1.0859E+09	9.7198E+08	2.5151E+07	4.3121E+04	1.3593E+04	1.3639E+09
23	44000.	6.7217E+08	1.1720E+09	7.2475E+06	1.0425E+04	1.3223E+03	9.9731E+08
24	46000.	6.7844E+08	1.8756E+09	1.0652E+06	4.7914E+03	1.2219E+02	7.2746E+08
25	48000.	5.1775E+08	2.7147E+09	1.8219E+05	1.3221E+03	1.1222E+01	5.3101E+08
26	50000.	3.9756E+08	3.4186E+09	1.3542E+05	3.7057E+02	1.0137E+00	3.9217E+08
27	52000.	2.8473E+08	3.8746E+09	3.8056E+04	1.0306E+02	9.1362E-02	2.8866E+08
28	54000.	2.1277E+08	4.8870E+09	1.1747E+04	2.5654E+01	7.8476E-03	2.1713E+08
29	55000.	1.8553E+08	5.2779E+09	3.5001E+03	6.5983E+00	6.3858E-04	1.8589E+08
30	58000.	1.1675E+08	6.1197E+09	1.9624E+03	1.6131E+00	5.0057E-05	1.1296E+08
31	60000.	8.4779E+07	6.9618E+09	8.1149E+02	3.7689E-01	3.7993E-06	8.0973E+07
32	62000.	5.7864E+07	7.7632E+09	3.9376E+01	8.4812E-02	2.6740E-07	5.7967E+07
33	64000.	4.0317E+07	8.5907E+09	2.4277E+01	1.7505E-02	1.6878E-08	4.0917E+07
34	66000.	2.8716E+07	9.3501E+09	6.0907E+00	3.7336E-03	9.6784E-10	2.8284E+07
35	68000.	1.9142E+07	9.9323E+09	1.0197E+00	6.5459E-04	4.2570E-11	1.9197E+07
36	70000.	1.2957E+07	1.0311E+10	5.0770E-01	7.5475E-05	1.4449E-12	1.3597E+07
37	72000.	8.2178E+06	1.0724E+10	1.2141E-01	1.1784E-05	5.2497E-14	8.0543E+06
38	74000.	4.9514E+06	1.0244E+10	2.7506E-02	1.9755E-06	1.5844E-15	4.9775E+06
39	75000.	2.9400E+06	1.0379E+10	4.9796E-03	2.1436E-07	4.2949E-17	2.9603E+06
40	78000.	1.5704E+06	9.1185E+09	7.6366E-04	2.7011E-08	1.1247E-18	1.6859E+06
41	80000.	9.0974E+05	8.1900E+09	1.0276E-04	3.1156E-09	3.1857E-20	9.4187E+05

K	ALT	CL		CLO		HCL		CLNO3	OCLX
1	0.	1.0385E+14	5.0370E-16	7.4687E+06	7.0936E-13	2.2734E+17	8.4742E-10	1.2304E+09	5.1031E-11	1.1000E-09
2	20000.	5.3000E+13	2.5099E-16	3.8020E+06	1.8077E-13	1.1222E+10	5.6649E-10	3.0866E+09	1.4663E-11	5.7000E-10
3	40000.	3.8423E+13	2.0129E-16	2.8858E+06	1.5481E-13	5.7213E+09	3.4654E-10	8.2118E+07	4.9738E-12	3.1000E-10
4	60000.	1.8344E+13	1.0370E-16	1.3809E+06	1.3440E-13	2.9815E+09	2.2250E-10	2.7501E+07	2.0523E-12	1.7000E-10
5	80000.	9.8479E+12	5.0137E-17	8.2335E+05	8.2411E-14	1.7798E+09	1.6359E-10	9.2725E+06	8.5225E-13	1.2000E-10
6	100000.	5.7397E+12	3.5715E-17	5.3105E+05	5.0901E-14	1.1148E+09	1.2765E-10	4.5997E+06	5.2670E-13	8.4000E-11
7	120000.	3.5940E+12	2.0830E-17	4.0350E+05	5.8785E-14	1.0756E+09	1.4972E-10	4.9495E+06	7.1597E-13	1.1000E-10
8	140000.	2.5637E+12	1.7044E-17	3.0141E+05	3.0114E-14	1.0124E+09	1.7069E-10	4.5705E+06	7.7062E-13	1.3000E-10
9	160000.	2.0263E+12	1.5711E-17	2.6320E+05	3.3739E-14	1.0865E+09	2.6480E-10	3.5410E+07	8.6303E-12	2.4000E-10
10	180000.	1.4991E+12	1.5024E-17	2.7345E+05	6.1418E-12	1.2646E+09	4.4760E-10	1.0575E+08	1.4368E-10	6.0000E-10
11	200000.	5.7154E+11	3.8277E-17	7.0734E+05	2.0367E-11	9.9248E+08	4.9623E-10	7.0573E+08	3.9767E-10	9.5000E-10
12	220000.	2.2986E+11	1.5417E-17	5.3397E+07	4.1215E-11	7.3912E+08	4.9624E-10	9.6510E+08	6.7536E-10	1.3000E-09
13	240000.	1.1018E+11	1.0078E-17	6.5468E+07	5.3457E-11	4.5808E+08	4.8264E-10	9.6929E+08	9.5923E-10	1.6000E-09
14	260000.	1.5016E+10	1.7188E-18	5.5481E+07	8.5267E-11	3.6947E+08	4.9627E-10	8.4657E+08	1.1371E-09	1.8000E-09
15	280000.	2.3119E+09	4.2684E-19	5.4243E+07	1.1845E-10	2.9271E+08	5.3975E-10	6.7576E+08	1.2454E-09	2.0000E-09
16	300000.	4.2178E+08	1.0119E-19	7.3610E+07	1.8396E-10	2.5577E+08	6.4497E-10	4.8037E+08	1.2100E-09	2.2000E-09
17	320000.	8.5113E+06	2.9418E-18	8.8705E+07	2.0639E-10	2.3645E+08	8.0865E-10	2.9631E+08	1.0134E-09	2.3000E-09
18	340000.	1.5058E+05	5.7765E-17	1.0646E+08	4.9310E-10	2.2114E+08	1.0243E-09	1.4473E+08	6.7074E-10	2.3000E-09
19	360000.	3.4508E+04	2.1573E-16	1.0898E+08	8.8433E-10	1.9234E+08	1.2062E-09	5.7829E+07	3.3559E-10	2.4000E-09
20	380000.	5.0262E+03	4.8607E-18	9.4525E+07	7.9234E-10	1.5954E+08	1.3235E-09	1.5046E+07	1.2559E-10	2.4000E-09
21	400000.	8.3305E+02	9.7065E-19	6.9580E+07	7.7320E-10	1.2952E+08	1.4396E-09	3.2426E+06	3.6033E-11	2.4000E-09
22	420000.	1.1950E+02	1.5180E-11	4.7538E+07	6.5835E-10	1.0756E+08	1.4823E-09	5.7002E+05	8.3851E-12	2.4000E-09
23	440000.	1.0078E+00	2.1271E-14	2.5756E+07	4.9304E-10	9.0019E+07	1.7454E-09	8.6056E+04	1.6674E-12	2.4000E-09
24	460000.	1.0564E+00	2.7037E-14	1.3517E+07	3.4291E-10	7.4801E+07	1.8990E-09	1.1893E+04	3.0194E-13	2.4000E-09
25	480000.	9.6343E+00	2.1744E-14	6.7914E+06	2.2377E-10	6.2140E+07	2.0147E-09	1.6817E+03	5.5410E-14	2.4000E-09
26	500000.	8.1382E+00	2.0534E-14	3.4986E+06	1.4726E-10	4.9571E+07	2.0882E-09	2.6951E+02	1.1362E-14	2.4000E-09
27	520000.	7.1089E+00	1.9515E-14	1.7967E+06	9.5778E-11	3.9768E+07	2.1370E-09	4.4687E+01	2.4025E-15	2.4000E-09
28	540000.	6.2460E+00	1.8629E-14	9.2765E+05	6.4030E-11	3.1867E+07	2.1663E-09	8.1950E+00	5.5710E-16	2.4000E-09
29	560000.	5.6264E+00	1.7369E-14	4.9405E+05	4.2437E-11	2.5374E+07	2.1859E-09	1.4722E+00	1.2702E-16	2.4000E-09
30	580000.	4.1246E+00	1.5295E-14	2.5335E+05	2.7844E-11	2.0119E+07	2.1987E-09	2.5970E-01	2.8523E-17	2.4000E-09
31	600000.	2.7801E+00	1.1044E-14	1.3041E+05	1.8252E-11	1.5764E+07	2.2066E-09	4.5711E-02	6.3986E-18	2.4000E-09
32	620000.	2.7201E+00	1.0378E-14	6.8971E+04	1.2415E-11	1.2468E+07	2.2107E-09	8.0870E-03	1.5413E-18	2.4000E-09
33	640000.	2.2479E+00	9.7944E-15	3.7139E+04	8.4236E-12	9.7705E+06	2.2126E-09	1.5890E-03	3.5982E-19	2.4000E-09
34	660000.	1.9317E+00	9.7324E-15	1.9432E+04	5.6745E-12	7.6016E+06	2.2130E-09	2.7475E-04	7.9984E-20	2.4000E-09
35	680000.	1.4503E+00	9.4707E-15	9.9401E+03	3.7574E-12	5.8825E+06	2.2136E-09	4.4808E-05	1.6832E-20	2.4000E-09
36	700000.	1.1003E+00	9.4545E-15	4.7916E+03	2.3207E-12	4.4870E+06	2.2151E-09	8.1799E-06	3.0503E-21	2.4000E-09
37	720000.	8.9548E+04	9.4522E-15	2.3083E+03	1.5275E-12	3.3367E+06	2.2128E-09	8.7686E-07	5.7125E-22	2.4000E-09
38	740000.	7.7949E+04	9.4158E-11	1.1470E+03	9.9637E-13	2.5453E+06	2.2095E-09	1.1549E-07	1.0025E-22	2.4000E-09
39	760000.	5.2158E+04	7.2934E-11	5.4767E+02	7.2103E-13	1.8727E+06	2.1975E-09	1.5694E-08	1.8347E-23	2.4000E-09
40	780000.	2.2526E+04	3.3594E-11	2.6721E+02	5.7921E-13	1.3642E+06	2.1719E-09	2.1584E-09	3.4523E-24	2.4000E-09
41	800000.	6.8401E+03	1.0315E-10	2.3231E+02	5.0989E-13	9.6651E+05	2.1214E-09	3.0077E-10	6.6016E-25	2.4000E-09

K	ALT	CL + O3	O1 + O2	HO2 + O3	HO2 + O	OH + O	NO2 + O	CLO + O	O + O3	O2 + HV
1	0.	7.9417E+08	2.4E+07	5.4705E+05	1.4673E+02	3.6164E-01	8.8136E+01	2.7855E+00	8.8991E+01	7.4835E-16
2	20000.	5.8447E+08	5.5239E+07	2.4738E+05	7.7405E+01	2.2654E-01	4.1214E+01	8.6979E-01	2.2102E+01	3.2922E-12
3	40000.	2.5775E+08	7.5835E+06	2.6019E+05	6.9392E+01	2.1305E-01	2.2037E+01	6.9632E-01	1.6249E+01	4.2505E-09
4	60000.	1.7378E+08	2.0279E+06	6.3525E+04	6.2644E+01	1.9374E-01	1.3987E+01	6.0268E-01	1.3468E+01	1.6987E-06
5	80000.	9.2444E+07	8.5744E+05	2.7892E+04	4.9936E+01	1.3878E-01	1.2168E+01	5.6900E-01	1.8559E+01	3.6228E-04
6	100000.	5.9876E+07	4.5424E+05	1.7922E+04	4.5281E+01	1.1891E-01	1.5191E+01	3.4958E-01	1.0947E+01	4.2985E-02
7	120000.	4.7788E+07	2.7775E+05	7.3564E+03	4.7742E+01	1.2870E-01	3.7021E+01	4.1427E-01	1.4508E+01	2.4349E+00
8	140000.	2.9463E+07	1.3536E+05	3.3377E+03	7.5975E+01	9.4879E-02	8.2393E+01	3.0273E-01	1.4495E+01	8.2552E+01
9	160000.	9.1032E+07	7.8832E+04	5.1224E+03	1.3199E+02	6.3859E-01	3.7900E+02	8.3717E+00	7.3107E+01	1.1865E+03
10	180000.	4.6320E+07	4.8213E+04	1.6511E+04	8.4158E+02	5.8556E+00	3.4245E+03	4.6015E+02	1.0468E+03	8.4255E+03
11	200000.	3.8056E+07	3.7061E+04	6.9952E+04	2.8814E+03	2.0950E+01	1.3093E+04	3.1373E+03	4.8776E+03	3.9724E+04
12	220000.	2.1052E+07	2.7382E+04	4.3593E+04	8.2721E+03	7.8980E+01	4.2756E+04	1.1224E+04	1.6464E+04	1.3824E+05
13	240000.	4.7643E+06	9.3379E+04	6.1452E+04	2.1256E+04	2.3071E+02	1.7443E+05	2.7987E+04	4.4728E+04	3.8619E+05
14	260000.	3.4310E+06	1.4769E+05	7.4922E+04	4.3516E+04	7.1164E+02	4.2241E+05	5.8134E+04	1.1156E+05	9.1633E+05
15	280000.	2.1375E+06	2.0639E+05	7.7418E+04	1.0145E+05	2.0179E+03	1.0835E+06	1.1556E+05	2.2713E+05	1.8784E+06
16	300000.	1.2817E+06	2.7127E+05	6.7934E+04	1.7417E+05	5.5702E+03	2.1428E+06	2.7869E+05	3.7980E+05	3.3449E+06
17	320000.	1.2051E+06	3.2516E+05	4.9597E+04	2.5834E+05	1.4647E+04	3.4268E+06	5.0720E+05	5.4674E+05	5.1818E+06
18	340000.	2.0304E+06	3.6718E+05	2.5771E+04	3.2617E+05	3.6249E+04	4.5557E+06	9.9717E+05	6.8903E+05	7.0137E+06
19	360000.	6.0728E+06	3.7123E+05	1.2644E+04	3.7182E+05	8.2838E+04	5.1736E+06	1.6374E+06	7.8262E+05	8.4190E+06
20	380000.	1.3796E+07	3.6373E+05	5.5356E+03	4.1813E+05	1.7559E+05	5.6930E+06	2.2390E+06	8.3284E+05	9.0646E+06
21	400000.	2.6626E+07	3.1195E+05	2.8744E+03	5.0145E+05	3.3397E+05	6.3282E+06	2.9950E+06	8.7918E+05	8.8813E+06
22	420000.	4.7324E+07	2.4568E+05	1.5396E+03	6.3951E+05	5.5308E+05	6.1633E+06	2.5899E+06	9.5217E+05	8.0973E+06
23	440000.	7.9938E+07	1.7744E+05	9.5706E+02	8.1239E+05	8.0107E+05	2.0029E+06	2.2110E+06	1.0227E+06	7.0271E+06
24	460000.	1.3652E+08	1.2392E+05	6.3557E+02	9.9321E+05	1.0151E+06	1.1297E+06	1.6073E+06	1.0295E+06	5.9112E+06
25	480000.	1.7163E+08	8.7756E+04	3.4455E+02	1.1428E+06	1.1470E+06	5.9300E+05	1.0308E+06	9.3355E+05	4.9129E+06
26	500000.	1.7195E+08	2.2277E+04	1.0759E+02	1.0573E+06	1.1071E+06	2.9049E+05	5.3249E+05	7.4696E+05	4.1122E+06
27	520000.	1.5925E+08	1.2715E+04	1.1159E+02	1.0766E+06	1.1061E+06	1.4575E+05	3.6985E+05	5.6024E+05	3.4706E+06
28	540000.	1.3671E+08	7.7657E+03	5.0844E+01	9.9052E+05	1.0520E+06	6.9678E+04	2.1752E+05	3.8972E+05	2.9935E+06
29	560000.	1.0971E+08	4.1955E+03	3.0166E+01	9.3348E+05	1.0096E+06	3.1832E+04	1.2185E+05	2.5402E+05	2.6134E+06
30	580000.	1.0770E+08	2.3729E+03	1.7721E+01	8.6032E+05	1.0261E+06	1.4359E+04	6.7126E+04	1.6460E+05	2.3018E+06
31	600000.	1.0527E+08	1.3586E+03	9.8126E+00	7.8418E+05	9.4721E+05	6.2961E+03	3.6482E+04	1.0276E+05	2.0337E+06
32	620000.	1.0372E+08	6.9479E+02	5.6423E+00	6.9274E+05	8.5532E+05	2.8233E+03	2.1412E+04	6.6016E+04	1.8036E+06
33	640000.	1.0413E+08	3.6014E+02	2.2319E+00	6.0016E+05	7.6421E+05	1.2467E+03	1.2632E+04	4.2793E+04	1.5855E+06
34	660000.	1.0602E+08	1.7654E+02	1.0554E+00	5.1957E+05	6.8034E+05	5.1110E+02	7.1140E+03	2.5456E+04	1.3940E+06
35	680000.	1.1161E+08	9.1487E+01	5.1759E-01	4.5665E+05	6.1708E+05	1.8672E+02	3.6084E+03	1.2737E+04	1.2525E+06
36	700000.	1.2833E+08	4.5177E+01	2.4273E-01	4.3236E+05	5.7559E+05	5.0865E+01	1.5865E+03	5.3336E+03	1.1483E+06
37	720000.	1.4621E+08	2.3633E+01	1.1497E-01	3.9271E+05	5.2891E+05	2.4184E+01	8.0142E+02	3.0131E+03	1.0826E+06
38	740000.	1.5336E+08	1.1804E+01	4.3856E-02	3.5538E+05	5.0837E+05	7.1064E+00	4.5788E+02	1.6211E+03	1.0202E+06
39	760000.	1.7205E+08	5.5916E+00	2.0903E-02	2.9657E+05	4.8826E+05	2.5812E+00	3.0622E+02	1.1111E+03	9.3831E+05
40	780000.	2.0583E+08	2.4866E+00	7.5532E-03	2.2715E+05	4.1749E+05	9.1468E-01	2.3555E+02	8.0636E+02	8.2851E+05
41	800000.	1.9815E+08	1.0184E+00	2.9208E-03	1.6038E+05	3.4826E+05	2.9826E-01	1.9754E+02	5.6441E+02	6.9775E+05
INTEGRATED LOSS FOR OZONE										
		4.4726E+11	5.4893E+11	9.4193E+10	2.8573E+12	2.9036E+12	6.7753E+12	3.4700E+12	2.1652E+12	1.9295E+13

K	ALT	H2O + HV	H2O + O1D	CH4 + O1D	HNO3 + HV	CO + OH	NO + HO2	JH2O2+H2O2	CL + CH4
1	0.	1.9734E+01	2.0207E+06	8.2082E+01	7.7040E+03	1.2178E+06	3.9572E+05	6.3616E+05	5.2160E+04
2	200000.	1.6774E+01	8.5143E+05	5.6835E+01	3.9061E+03	6.5737E+05	1.4152E+05	3.6073E+05	1.7363E+04
3	400000.	1.3483E+01	4.7351E+05	2.6276E+01	1.7952E+03	7.9147E+05	5.0911E+04	2.1856E+05	6.3570E+03
4	600000.	1.2276E+01	2.9731E+05	1.1500E+01	8.6550E+02	2.1490E+05	2.6538E+04	1.1907E+05	2.3681E+03
5	800000.	1.1064E+01	1.8282E+04	4.8647E+00	5.0044E+02	9.5249E+04	1.3192E+04	4.8396E+04	7.8246E+02
6	1000000.	1.0896E+01	1.4932E+04	3.4107E+00	3.2897E+02	4.2695E+04	6.8509E+03	1.8711E+04	2.7244E+02
7	1200000.	1.0662E+01	8.5647E+03	2.9531E+00	2.6587E+02	1.9588E+04	5.0321E+03	6.5387E+03	1.5077E+02
8	1400000.	1.0114E+01	7.2119E+03	8.8772E+01	7.8467E+02	8.3048E+03	3.7745E+03	4.7545E+03	7.2608E+01
9	1600000.	4.2245E+00	6.6387E+02	1.7502E+02	8.4770E+02	6.6573E+03	2.6436E+03	3.2627E+03	1.3855E+02
10	1800000.	1.0401E+02	2.2736E+02	7.6831E+02	2.6499E+03	5.7620E+03	2.3745E+03	4.9198E+03	2.0259E+02
11	2000000.	1.6595E+02	3.6244E+02	6.6236E+02	2.8732E+03	4.7310E+03	2.5758E+03	6.9197E+03	3.1078E+02
12	2200000.	2.4121E+02	2.3947E+02	9.3347E+02	3.6502E+03	3.6499E+03	3.3647E+03	9.3794E+03	2.8959E+02
13	2400000.	3.4865E+02	2.0751E+02	1.2730E+03	5.7140E+03	3.5019E+03	5.0534E+03	1.2230E+04	2.6122E+02
14	2600000.	4.9432E+02	1.8426E+02	2.6549E+03	8.8715E+03	3.7405E+03	8.3247E+03	1.4442E+04	2.5411E+02
15	2800000.	6.8299E+02	2.8877E+14	2.6984E+03	1.2557E+04	4.3275E+03	1.2628E+04	1.5228E+04	2.7058E+02
16	3000000.	8.8256E+02	6.3144E+06	2.2230E+03	1.5250E+04	5.2520E+03	1.6438E+04	1.3728E+04	3.3308E+02
17	3200000.	1.0474E+03	7.0372E+04	2.2372E+03	1.5806E+04	6.7547E+03	1.7941E+04	1.0079E+04	4.4997E+02
18	3400000.	1.1934E+03	7.6858E+04	2.9097E+03	1.3501E+04	7.2897E+03	1.6498E+04	5.9521E+03	6.2137E+02
19	3600000.	1.2454E+03	6.3928E+04	1.5629E+03	9.9462E+03	7.7496E+03	1.3535E+04	3.0845E+03	7.7006E+02
20	3800000.	1.2232E+03	7.2241E+04	1.1565E+03	5.0774E+03	7.5260E+03	1.0606E+04	1.5991E+03	8.3449E+02
21	4000000.	1.1149E+03	6.9116E+04	9.4259E+02	2.7683E+03	6.5667E+03	8.3245E+03	9.6167E+02	7.6911E+02
22	4200000.	9.7405E+02	5.0630E+04	5.9293E+02	1.6976E+03	5.1307E+03	6.4856E+03	6.9264E+02	6.1450E+02
23	4400000.	8.1676E+02	2.7525E+04	4.0094E+02	1.0745E+03	4.0345E+03	5.1564E+02	4.4496E+02	
24	4600000.	6.8705E+02	1.7272E+04	2.7057E+02	8.4045E+01	3.0964E+03	3.4590E+03	4.3103E+02	3.0398E+02
25	4800000.	5.8425E+02	1.2156E+04	2.0757E+02	2.3009E+01	2.1479E+03	2.3052E+03	3.2830E+02	1.9792E+02
26	5000000.	5.5402E+02	9.5483E+03	1.1902E+02	6.7305E+00	1.6503E+03	1.4738E+03	2.4963E+02	1.2375E+02
27	5200000.	5.3593E+02	8.0837E+03	7.9912E+01	1.9766E+00	1.2892E+03	9.2119E+02	1.8486E+02	7.6250E+01
28	5400000.	7.7443E+02	4.9619E+03	5.5041E+01	6.1437E+01	1.0432E+03	5.5796E+02	1.3743E+02	4.5638E+01
29	5600000.	2.6805E+02	3.4327E+03	3.7707E+01	1.9104E-01	8.5805E+02	3.4020E+02	1.0548E+02	2.7162E+01
30	5800000.	9.1915E+02	2.5375E+03	2.5160E+01	5.7645E-02	6.9009E+02	2.0105E+02	7.7798E+01	1.6020E+01
31	6000000.	9.4153E+02	1.5334E+03	1.6932E+01	1.7245E-02	5.4418E+02	1.1504E+02	5.6775E+01	9.2909E+00
32	6200000.	7.7223E+02	1.0188E+03	1.0343E+01	5.0277E-03	4.0105E+02	6.0105E+01	3.6080E+01	5.1360E+00
33	6400000.	5.0389E+02	5.9335E+02	3.0777E+00	1.3779E-03	2.7676E+02	2.9296E+01	2.1132E+01	2.8000E+00
34	6600000.	2.6552E+02	2.8965E+02	8.4173E+01	3.7166E-04	1.8895E+02	1.4821E+01	1.3059E+01	1.4954E+00
35	6800000.	9.3435E+02	1.1957E+02	4.1859E+00	1.0578E-04	1.3529E+02	7.6456E+00	1.0066E+01	7.6922E-01
36	7000000.	3.0726E+02	1.2773E+02	2.4814E+00	3.6771E-05	5.8706E+02	4.3035E+00	9.3611E+00	3.6664E-01
37	7200000.	9.2097E+01	5.1237E+01	4.7273E+00	7.3283E-06	7.2606E+02	1.9557E+00	6.8596E+00	1.813uE-01
38	7400000.	2.7698E+02	2.6574E+01	1.6742E-06	8.5135E-01	3.9316E+00	8.7495E-02		
39	7600000.	7.8988E+01	1.3403E+01	3.0714E-01	3.0509E-07	8.2572E+02	2.8257E-01	1.6346E+00	4.5673E-02
40	7800000.	2.2877E+02	7.0155E+00	7.2071E-01	4.7029E-08	7.2204E+02	7.7378E-02	5.1523E-01	2.5751E-02
41	8000000.	3.2509E+02	7.8436E+00	5.7973E-01	6.3489E-09	5.9028E+02	1.8327E-02	1.3581E-01	1.5508E-02

K	ALT	H2O2 + OH	HO2 + OH	HCL + OH	CH4 + OH	O3 + NO2	OH + HNO3	OH + OH	H + HO2	CL + HO2
1	0.	4.1209E+06	1.0283E+05	5.7270E+04	1.0950E+06	2.7184E+04	1.9480E+04	4.7118E+01	9.5667E-03	4.2866E+02
2	20000.	7.8324E+05	7.8344E+04	1.8732E+04	4.0746E+05	9.6811E+03	5.7859E+03	1.8320E+01	3.9399E-03	1.4038E+02
3	40000.	1.6276E+05	4.0826E+04	5.0213E+03	2.2350E+05	3.0787E+03	1.8935E+03	1.1490E+01	2.4408E-03	5.9699E+01
4	60000.	3.9827E+04	2.4172E+04	2.5109E+03	1.0445E+05	1.5149E+03	6.2939E+02	8.3547E+00	1.3422E-03	2.4598E+01
5	80000.	1.2468E+04	8.2782E+03	8.2131E+02	3.4525E+04	6.8917E+02	1.8305E+02	2.1642E+00	4.7973E-04	8.3881E+00
6	90000.	2.8321E+03	3.4913E+03	2.8345E+02	1.2399E+04	3.0855E+02	6.0580E+01	7.5974E-01	1.7842E-04	3.0982E+00
7	120000.	1.2364E+02	1.2577E+03	1.3579E+02	3.5557E+03	1.4231E+02	2.5482E+01	3.1334E-01	6.9287E-05	1.0899E+00
8	140000.	1.3440E+01	4.1172E+02	7.4441E+01	9.9644E+02	4.8158E+01	1.5912E+01	8.9930E-02	1.9452E-05	8.4540E-01
9	160000.	1.5994E+00	1.3259E+02	1.7259E+01	8.9715E+02	9.0508E+00	5.0350E+00	2.8836E-01	2.9942E-05	2.8528E+00
10	180000.	1.7638E+00	1.6558E+02	2.2986E+02	1.2490E+03	2.3962E+02	2.2670E+02	9.8062E-01	7.6560E-05	1.0383E+01
11	200000.	8.2055E+02	1.7267E+02	3.4038E+02	1.3499E+03	3.7234E+02	4.5670E+02	1.9277E+00	1.5562E-04	1.8216E+01
12	220000.	1.7586E+03	2.1361E+02	3.7268E+02	1.7966E+03	4.4844E+02	6.5464E+02	3.4054E+00	3.2662E-04	2.7004E+01
13	240000.	2.7424E+03	5.4702E+02	3.2280E+02	1.3730E+03	6.5019E+02	7.8792E+02	6.2126E+00	7.7650E-04	3.9570E+01
14	260000.	3.6706E+03	9.7105E+02	2.4410E+02	1.3762E+03	9.7287E+02	8.7677E+02	1.1874E+01	1.8144E-03	5.8534E+01
15	280000.	4.7501E+03	1.4411E+03	3.3317E+02	1.4139E+03	1.3478E+03	8.7365E+02	2.4606E+01	4.7192E-03	9.2965E+01
16	300000.	5.1379E+03	2.0358E+03	5.3688E+02	1.4865E+03	1.6092E+03	8.2390E+02	5.5765E+01	1.3141E-02	1.6132E+02
17	320000.	4.2336E+03	2.7212E+03	7.7547E+02	1.5551E+03	1.6552E+03	7.5744E+02	1.3045E+02	3.7548E-02	2.8191E+02
18	340000.	2.7243E+03	3.1884E+03	1.2145E+03	1.5855E+03	1.4735E+03	6.5449E+02	2.9184E+02	1.0502E-01	4.5219E+02
19	360000.	1.4989E+03	3.1793E+03	1.4225E+03	1.5196E+03	1.0455E+03	5.1064E+02	5.9456E+02	2.7807E-01	6.1622E+02
20	380000.	7.0893E+02	2.8736E+03	1.4279E+03	1.3479E+03	6.2360E+02	3.3512E+02	1.0635E+03	7.1894E-01	7.3610E+02
21	400000.	4.6419E+02	2.7 80E+03	1.5035E+03	1.0757E+03	2.9282E+02	1.6441E+02	1.5338E+03	1.8178E+00	8.0290E+02
22	420000.	3. 170E+02	2.6+63E+03	1.5349E+03	7.7372E+02	1.0661E+02	5.8496E+01	1.7379E+03	4.3490E+00	8.0423E+02
23	440000.	2.3681E+02	1.9726E+03	1.2108E+03	5.2608E+02	3.2376E+02	1.5466E+01	1.6539E+03	9.4050E+00	7.3515E+02
24	460000.	1.8224E+02	1.5465E+03	9.4277E+02	3.4987E+02	8.8866E+01	4.0406E+00	1.3862E+03	1.7633E+01	6.1146E+02
25	480000.	1.3475E+01	1.1475E+03	6.8659E+02	2.2369E+02	2.4285E+01	1.4695E-01	1.0691E+03	2.8539E+01	4.6756E+02
26	500000.	9.55.0E+01	7.5180E+02	4.3706E+02	1.4143E+02	6.9828E+00	2.7232E-01	8.2263E+02	4.1094E+01	3.5017E+02
27	520000.	3.8715E+01	1.8275E+02	1.7716E+02	8.6195E+01	2.0335E+00	5.0899E-02	6.1515E+02	5.5344E+01	2.5266E+02
28	540000.	2.1456E+01	4.7705E+01	2.3454E+02	5.3442E+01	6.2698E-01	1.4648E-02	4.7155E+02	7.1839E+01	1.8360E+02
29	560000.	1.7105E+01	8.7324E+03	1.6179E+02	3.2190E+01	1.9490E-01	3.8464E-03	3.7371E+02	9.4058E+01	1.3421E+02
30	580000.	7.4557E+00	6.3635E+03	1.0369E+02	2.0714E+01	5.8045E-02	9.6176E-04	2.8516E+02	1.1947E+02	9.4996E+01
31	600000.	4.2519E+00	3.1145E+03	7.3735E+01	1.2226E+01	1.7451E-02	2.3616E-04	2.1703E+02	1.4841E+02	6.6716E+01
32	620000.	2.2796E+00	1.4324E+03	4.8759E+01	7.6202E+00	5.0802E-03	5.2589E-05	1.5041E+02	1.6505E+02	4.4396E+01
33	640000.	8.7837E-01	9.1377E+02	2.8452E+01	3.7144E+00	1.3884E-03	1.0598E-05	9.7947E+01	1.7448E+02	2.8446E+01
34	660000.	4.4975E-01	6.1011E+02	1.7545E+01	1.7015E+00	3.7782E-04	2.1581E-06	6.7659E+01	1.9336E+02	1.8720E+01
35	680000.	2.9442E-01	5.1568E+02	1.2004E+01	9.4750E-01	1.0729E-04	5.1490E-07	5.6956E+01	2.4964E+02	1.3508E+01
36	700000.	2.0421E-01	5.4245E+02	8.6365E+00	5.5375E-01	3.4078E-05	1.3140E-07	5.6540E+01	3.7916E+02	1.0246E+01
37	720000.	1.1060E-01	5.5287E+02	5.4283E+00	2.7390E-01	7.3531E-06	2.4766E-08	4.2674E+01	4.7516E+02	6.8588E+00
38	740000.	5.7783E-02	5.5393E+02	3.3741E+00	1.2454E-01	1.6797E-06	4.4271E-09	3.2737E+01	6.0395E+02	4.6129E+00
39	760000.	1.5451E-02	1.3467E+02	1.7462E+00	5.3931E-02	3.6562E-07	5.7225E-10	1.8074E+01	5.7741E+02	2.7668E+00
40	780000.	6.8390E-03	5.3905E+01	8.0643E-01	1.9052E-02	4.7178E-08	4.9148E-11	8.3470E+00	4.5190E+02	1.6153E+00
41	800000.	4.0978E-04	1.8978E+01	3.4561E-01	6.1443E-03	6.3527E-09	3.7456E-12	3.4836E+00	3.0415E+02	9.5650E-01

MIXING RATIOS:

ALT	N2O	NOX	CH4	FC11	FC12	CH3C	CLX	CCL4	H2
0.	2.5000E-07	1.8523E-08	1.5001E-06	7.7938E-11	1.6168E-10	1.5000E-09	9.9451E-10	1.3000E-10	5.0000E-07
20000.	2.4932E-07	1.8326E-08	1.4809E-06	7.7087E-11	1.6161E-10	1.4264E-09	5.8133E-10	1.2991E-10	4.9620E-07
40000.	2.4881E-07	1.8124E-08	1.4813E-06	7.7826E-11	1.6152E-10	1.3836E-09	3.5166E-10	1.2980E-10	4.9418E-07
60000.	2.4969E-07	1.8175E-08	1.4775E-06	7.7743E-11	1.6142E-10	1.3588E-09	2.2468E-10	1.2966E-10	4.9308E-07
80000.	2.4938E-07	1.8175E-08	1.4753E-06	7.7657E-11	1.6129E-10	1.3459E-09	1.6452E-10	1.2949E-10	4.9249E-07
100000.	2.4916E-07	1.8208E-08	1.4723E-06	7.7426E-11	1.6098E-10	1.3322E-09	1.2824E-10	1.2907E-10	4.9170E-07
120000.	2.4833E-07	1.8265E-08	1.4672E-06	7.6936E-11	1.6031E-10	1.3146E-09	1.0050E-10	1.2818E-10	4.9035E-07
140000.	2.4737E-07	1.8230E-08	1.4624E-06	7.6342E-11	1.5951E-10	1.2991E-09	1.7150E-10	1.2711E-10	4.8885E-07
160000.	2.4196E-07	1.1426E-08	1.4315E-06	7.7357E-11	1.5505E-10	1.2276E-09	2.7376E-10	1.2114E-10	4.8602E-07
180000.	2.2314E-07	5.4598E-09	1.3300E-06	8.1890E-11	1.7963E-10	1.0136E-09	5.9704E-10	1.0045E-10	4.5348E-07
200000.	2.0227E-07	2.2558E-09	1.2434E-06	8.9107E-11	1.2247E-10	8.1104E-10	9.1366E-10	7.7587E-11	4.2374E-07
220000.	1.7900E-07	8.7120E-10	1.1273E-06	3.5085E-11	1.0379E-10	6.7761E-10	1.2122E-09	5.3892E-11	3.9221E-07
240000.	1.5546E-07	1.1407E-09	9.9973E-07	2.3582E-11	8.4014E-11	4.6695E-10	1.4650E-09	3.1836E-11	3.5903E-07
260000.	1.2417E-07	1.9014E-08	8.6857E-07	1.2427E-11	6.4047E-11	2.8897E-10	1.7187E-09	1.4924E-11	3.2460E-07
280000.	1.1145E-07	1.6739E-08	7.4617E-07	5.2330E-12	4.5164E-11	2.5221E-10	2.0042E-09	5.0982E-12	2.8919E-07
300000.	7.6571E-08	1.3765E-08	6.2660E-07	1.7240E-12	2.9408E-11	1.6802E-10	2.0384E-09	1.2607E-12	2.5422E-07
320000.	5.6148E-08	1.0730E-08	5.1267E-07	4.4189E-13	1.7047E-11	1.0591E-10	2.1295E-09	1.9533E-13	2.2102E-07
340000.	3.9833E-08	2.6559E-09	4.1247E-07	8.7688E-14	1.0307E-11	6.3497E-11	2.1888E-09	2.3047E-14	1.9070E-07
360000.	2.8124E-08	7.1183E-09	3.6490E-07	2.8053E-14	5.8427E-12	3.9967E-11	2.2251E-09	2.2232E-15	1.6457E-07
380000.	1.9912E-08	2.9826E-09	2.5674E-07	3.3973E-15	3.3216E-12	1.9878E-11	2.2463E-09	4.9628E-16	1.4334E-07
400000.	1.4311E-08	8.7878E-10	1.9683E-07	6.6819E-16	1.9308E-12	1.0987E-11	2.2580E-09	1.7761E-17	1.2778E-07
420000.	1.0217E-08	2.6038E-10	1.4657E-07	1.4657E-16	1.1308E-12	6.2680E-12	2.2643E-09	1.7668E-18	1.1811E-07
440000.	7.3510E-09	1.0332E-10	1.2740E-07	5.4019E-17	7.2500E-13	3.7979E-12	2.2676E-09	2.0374E-19	1.1417E-07
460000.	6.2022E-09	1.0469E-08	1.0734E-07	9.1781E-18	4.7772E-13	2.4757E-12	2.2694E-09	2.7845E-20	1.1547E-07
480000.	4.8525E-09	1.7619E-08	9.5163E-06	2.7536E-18	3.2164E-13	1.7736E-12	2.2705E-09	4.4525E-21	1.2102E-07
500000.	4.0831E-09	1.6832E-08	8.6983E-06	9.2645E-19	2.2505E-13	1.3048E-12	2.2711E-09	8.3802E-22	1.3021E-07
520000.	3.4421E-09	1.5913E-08	8.0858E-08	3.4601E-19	1.6341E-13	1.0462E-12	2.2715E-09	1.8539E-22	1.4201E-07
540000.	2.7706E-09	1.4439E-08	7.8623E-08	1.4193E-19	1.2196E-13	8.8211E-13	2.2717E-09	4.7096E-23	1.5575E-07
560000.	2.5151E-09	1.3451E-08	7.0518E-08	6.3845E-20	9.3421E-14	7.7315E-13	2.2719E-09	1.3651E-23	1.7077E-07
580000.	2.3454E-09	1.2403E-08	7.5354E-08	3.0415E-20	7.3263E-14	6.9812E-13	2.2720E-09	4.4563E-24	1.8667E-07
600000.	2.1370E-09	1.1734E-08	7.4281E-08	1.5216E-20	5.8531E-14	6.4448E-13	2.2721E-09	1.6036E-24	2.0321E-07
620000.	1.9717E-09	1.0989E-08	7.4109E-08	8.4894E-21	4.8033E-14	6.0641E-13	2.2721E-09	6.4137E-25	2.1951E-07
640000.	1.8472E-09	1.0265E-08	7.3852E-08	4.8931E-21	4.0553E-14	5.7886E-13	2.2722E-09	2.8716E-25	2.3521E-07
660000.	1.7478E-09	9.6234E-09	7.3646E-08	3.0352E-21	3.4944E-14	5.5730E-13	2.2722E-09	1.3898E-25	2.5090E-07
680000.	1.6568E-09	9.0146E-09	7.3561E-08	2.0229E-21	3.0775E-14	5.4048E-13	2.2722E-09	7.2620E-26	2.6618E-07
700000.	1.5803E-09	8.2179E-09	7.3458E-08	1.3397E-21	2.7706E-14	5.2729E-13	2.2722E-09	4.1235E-26	2.8059E-07
720000.	1.5534E-09	8.2471E-09	7.3408E-08	1.0142E-21	2.5304E-14	5.1678E-13	2.2722E-09	2.5028E-26	2.9345E-07
740000.	1.5113E-09	4.6204E-09	7.3372E-08	7.6820E-22	2.3656E-14	5.0846E-13	2.2722E-09	1.6156E-26	3.0400E-07
760000.	1.4812E-09	3.4878E-09	7.3745E-08	6.0536E-22	2.2351E-14	5.0192E-13	2.2722E-09	1.0992E-26	3.1142E-07
780000.	1.4546E-09	2.8942E-09	7.3324E-08	4.9209E-22	2.1295E-14	4.9677E-13	2.2722E-09	7.7367E-27	3.1525E-07
800000.	1.4336E-09	2.8217E-09	7.3175E-08	4.0949E-22	2.0505E-14	4.9275E-13	2.2722E-09	5.4942E-27	3.1592E-07

FN2O = -1.82171E+09 FNOX = -1.94491E+10 FCH4 = -2.85427E+11 FF11 = -8.62317E+05 FF12 = -1.09231E+06

FCH3C = -1.69402E+09 FCLX = -3.41764E+09 FCCL4 = -1.44844E+06 FH2 = -9.21821E+10

K	ALT	MR O3	FC11	FC12	CH3CL	CCL4	CLX
1	0.	2.9792E-08	1.3721E+09	3.8930E+09	7.6165E+10	3.1343E+09	2.3978E+10
2	200000.	2.8275E-08	1.1395E+09	3.4013E+09	3.0020E+10	2.7346E+09	1.2237E+10
3	400000.	2.9378E-08	1.3649E+09	2.5557E+09	2.2843E+10	2.1429E+09	5.8059E+09
4	600000.	3.2760E-08	1.0418E+09	2.167 E+09	1.8208E+10	1.7774E+09	3.0108E+09
5	800000.	3.1303E-08	5.4487E+08	1.7548E+09	1.4043E+10	1.4888E+09	1.7900E+09
6	1000000.	3.3140E-08	6.7626E+08	1.4058E+09	1.1034E+10	1.1272E+09	1.1139E+09
7	1200000.	8.648EE-08	5.3665E+08	1.1393E+09	9.0875E+09	8.5614E+08	1.0404E+09
8	1400000.	1.2775E-07	4.5278E+08	9.4505E+08	7.7051E+09	7.5387E+08	1.0171E+09
9	1600000.	3.5003E-07	2.3775E+08	6.7516E+08	5.0367E+09	4.9702E+08	1.1232E+09
10	1800000.	1.1379E-06	1.7422E+08	3.9431E+08	2.8539E+09	2.8367E+08	1.6860E+09
11	2000000.	2.2163E-06	9.3214E+07	2.4437E+08	1.0237E+09	1.5517E+08	1.8273E+09
12	2200000.	3.5431E-06	3.1061E+07	1.4801E+08	9.1114E+08	7.7011E+07	1.7323E+09
13	2400000.	5.2197E-06	2.7821E+07	8.0737E+07	5.1253E+08	3.2895E+07	1.5325E+09
14	2600000.	7.0257E-06	[illegible]	4.7586E+07	2.5723E+08	1.1111E+07	1.2796E+09
15	2800000.	8.6314E-06	[illegible]	2.4534E+07	1.3677E+08	2.7548E+06	1.0327E+09
16	3000000.	9.5697E-06	[illegible]	1.1675E+07	6.6704E+07	4.7650E+05	8.0926E+08
17	3200000.	9.2247E-06	1.2921E+05	5.2185E+06	3.1369E+07	5.7116E+04	6.2268E+08
18	3400000.	[illegible]	[illegible]	2.2245E+06	1.3023E+07	4.9757E+03	4.7257E+08
19	3600000.	[illegible]	2.3957E+07	9.2711E+05	5.7691E+06	3.5651E+02	3.5691E+08
20	3800000.	5.1390E-06	[illegible]	3.9792E+05	2.7814E+06	2.3515E+01	2.6911E+08
21	4000000.	7.5995E-06	[illegible]	1.7375E+05	9.0876E+05	1.5983E+00	2.0326E+08
22	4200000.	[illegible]	[illegible]	7.8763E+04	4.2010E+05	1.2011E-01	1.5392E+08
23	4400000.	2.4989E-06	1.7368E+00	3.7417E+04	1.9601E+05	1.0515E-02	1.1703E+08
24	4600000.	[illegible]	[illegible]	1.8655E+04	9.7510E+04	1.0958E-03	8.9392E+07
25	4800000.	1.9344E-06	[illegible]	9.7345E+03	[illegible]	1.7513E-04	6.8999E+07
26	5000000.	1.6372E-06	2.1976E-02	5.7331E+03	7.0050E+04	1.9878E-05	5.3870E+07
27	5200000.	1.7989E-06	[illegible]	7.3394E+03	1.0455E+04	3.4482E-06	4.2249E+07
28	5400000.	1.2795E-06	[illegible]	1.7340E+03	1.2976E+04	6.9278E-07	3.7427E+07
29	5600000.	1.0038E-06	7.7340E-04	1.0328E+03	8.9618E+03	1.5822E-07	2.6371E+07
30	5800000.	[illegible]	2.7692E-04	[illegible]	6.750 E+03	4.0575E-08	2.0685E+07
31	6000000.	7.3345E-07	1.1095E-04	4.1814E+02	4.6041E+03	1.1456E-08	1.6232E+07
32	6200000.	[illegible]	4.7796E-05	2.7172E+02	3.4177E+03	7.6148E-09	1.2806E+07
33	6400000.	[illegible]	2.2050E-05	1.7208E+02	2.5562E+03	1.2681E-09	1.0034E+07
34	6600000.	[illegible]	[illegible]	1.2007E+02	1.9145E+03	4.7713E-10	7.8049E+06
35	6800000.	5.4113E-07	[illegible]	[illegible]	1.4768E+03	1.9372E-10	6.0486E+06
36	7000000.	4.2995E-07	2.335 E-06	5.6172E+01	1.0603E+03	3.3542E-11	4.6035E+06
37	7200000.	3.9991E-07	[illegible]	3.8979E+01	7.9726E+02	3.3418E-11	3.4879E+06
38	7400000.	[illegible]	[illegible]	2.7252E+01	5.8575E+02	1.8611E-11	2.6176E+06
39	7600000.	3.0127E-07	[illegible]	1.9119E+01	4.2935E+02	9.4023E-12	1.9457E+06
40	7800000.	[illegible]	[illegible]	1.3414E+01	3.1202E+02	4.8594E-12	1.4272E+06
41	8000000.	4.973 E-07	[illegible]	9.7829E+00	2.2450E+02	2.5032E-12	1.0352E+06

K	ALT	N2O	NOX	CH4
1	.0	3.0227E+16	4.+3.5E+10	3.6[illegible]E+17
2	2000.0	2.2647E+12	2.1737E+11	3.1967E+17
3	4000.0	+.1344E+12	3.7641E+09	2.+57E+13
4	6000.0	3.7+86E+12	4.3+76E+09	1.+778E+17
5	8000.0	3.71.9E+12	2.3400E+09	1.5[illegible]E+17
6	10000.0	2.1753E+12	1.6789E+09	1.7+58E+17
7	12000.0	1.7+69E+12	2.2772E+09	1.7+43E+17
8	14000.0	1.4[illegible]E+12	2.8866E+09	8.68[illegible]E+12
9	16000.0	9.9271E+11	+.[illegible]E+09	5.873E+12
10	18000.0	6.7+17E+11	2.6798E+09	3.7+76E+12
11	20000.0	+.[illegible]E+11	+.2162E+10	2.4421E+12
12	22000.0	2.+59E+11	+.[illegible]E+10	1.5933E+12
13	24000.0	1.+983E+11	1.1772E+10	1.+610E+12
14	26000.0	8.[illegible]E+10	1.0+73E+10	5.+072E+11
15	28000.0	5.[illegible]E+10	8.[illegible]E+09	4.+65E+11
16	30000.0	3.[illegible]E+10	7.[illegible]E+09	2.497E+11
17	32000.0	1.[illegible]E+10	5.7[illegible]E+09	1.5[illegible]E+11
18	34000.0	8.[illegible]E+09	+.+39[illegible]E+09	8.9952E+10
19	36000.0	+.[illegible]E+09	3.[illegible]E+09	5.212E+10
20	38000.0	2.[illegible]E+09	2.[illegible]E+09	3.+27[illegible]E+10
21	40000.0	1.+[illegible]E+09	+.[illegible]E+09	1.77+[illegible]E+10
22	42000.0	7.[illegible]E+08	+.[illegible]E+09	1.+59[illegible]E+10
23	44000.0	4.[illegible]E+08	3.[illegible]E+08	8.564[illegible]E+09
24	46000.0	2.+4+[illegible]E+08	+.[illegible]E+08	+.251[illegible]E+09
25	48000.0	1.+[illegible]E+08	8.[illegible]E+08	2.8832E+09
26	50000.0	8.67[illegible]E+07	8.[illegible]E+08	2.+[illegible]E+09
27	52000.0	6.+[illegible]E+07	+.[illegible]E+08	1.5[illegible]E+09
28	54000.0	+.[illegible]E+07	6.[illegible]E+08	1.1556E+09
29	56000.0	3.[illegible]E+07	1.[illegible]E+08	8.[illegible]E+08
30	58000.0	+.[illegible]E+07	1.[illegible]E+08	5.[illegible]E+08
31	60000.0	1.[illegible]E+07	+.[illegible]E+07	5.329[illegible]E+08
32	62000.0	1.110[illegible]E+07	5.[illegible]E+07	4.1[illegible]E+08
33	64000.0	+.[illegible]E+06	+.[illegible]E+07	3.[illegible]E+08
34	66000.0	6.[illegible]E+06	2.[illegible]E+07	2.[illegible]E+08
35	68000.0	+.[illegible]E+06	1.[illegible]E+07	1.9[illegible]E+08
36	70000.0	+.[illegible]E+06	+.[illegible]E+07	+.[illegible]E+08
37	72000.0	2.[illegible]E+06	9.[illegible]E+06	1.[illegible]E+08
38	74000.0	1.7+65E+06	+.[illegible]E+06	8.4324E+07
39	76000.0	1.+[illegible]E+06	3.[illegible]E+06	6.[illegible]E+07
40	78000.0	3.+[illegible]E+05	1.[illegible]E+06	4.[illegible]E+07
41	80000.0	8.[illegible]E+05	7.[illegible]E+05	3.[illegible]E+07

NORMAL JOB END.

CASE 2

LAST ITERATION = 7

ALT	CLO2	CL03	CLOF2	CLOF3	CL2O6	PREVO2	OO2INT	O4INT	PREVOH
0.	3.585E-22	2.294E-24	8.955E-26	4.048E-28	5.504E-06	7.216E+11	9.417E+18	2.194E+25	2.628E+06
20000.	5.139E-22	2.934E-24	1.539E-25	5.512E-27	1.911E-05	5.025E+11	8.284E+18	1.743E+25	3.072E+06
40000.	7.521E-22	3.978E-24	1.136E-23	3.786E-26	1.214E-05	4.389E+11	8.175E+18	1.567E+25	2.838E+06
60000.	5.767E-22	3.151E-24	7.365E-21	2.625E-20	1.353E-05	4.372E+11	8.083E+18	1.464E+25	2.305E+06
80000.	6.317E-22	3.195E-24	7.283E-19	1.410E-17	1.453E-05	4.104E+11	7.998E+18	8.253E+24	1.459E+06
100000.	4.649E-22	3.265E-24	7.175E-17	9.785E-16	1.535E-05	4.402E+11	7.912E+18	6.293E+24	8.983E+05
120000.	4.718E-18	3.241E-24	3.604E-15	4.441E-14	1.588E-05	5.672E+11	7.80E+18	4.727E+24	5.733E+05
140000.	4.891E-17	3.245E-24	1.259E-13	1.415E-12	1.636E-05	7.105E+11	7.685E+18	3.447E+24	3.971E+05
160000.	8.893E-16	3.243E-24	2.531E-12	2.826E-11	1.681E-05	1.037E+12	7.475E+18	2.433E+24	4.203E+05
180000.	3.85UE-15	3.242E-24	3.911E-11	3.981E-10	1.735E-05	1.640E+12	7.033E+18	1.747E+24	7.033E+05
200000.	3.790E-14	3.253E-24	4.139E-10	3.42E-09	1.349E-05	4.050E+12	6.323E+18	1.20UE+24	9.053E+05
220000.	2.790E-13	3.293E-24	3.3UE-09	9.976E-09	2.390E-05	4.65UE+12	5.451E+18	9.217E+23	1.148E+06
240000.	1.672E-12	3.333E-24	2.33E-10	3.7UE-08	3.116E-05	4.39UE+12	4.485E+18	6.752E+23	1.525E+06
260000.	8.497E-12	3.539E-24	1.471E-08	1.211E-07	4.591E-05	4.871E+12	3.499E+18	4.976E+23	2.090E+06
280000.	1.73UE-11	3.737E-24	7.833E-08	3.231E-07	6.332E-05	5.30UE+12	2.576E+18	3.539E+23	2.395E+06
300000.	2.291E-11	4.223E-24	2.293E-07	7.245E-07	1.10UE-04	7.49UE+12	1.796E+18	2.75UE+23	4.416E+06
320000.	4.642E-11	4.3-6E-24	1.34UE-07	1.23UE-06	1.906E-04	2.612E+12	1.180E+18	2.060E+23	6.610E+06
340000.	3.29UE-11	6.115E-24	6.775E-07	2.024E-06	2.90UE-04	4.71UE+12	7.41UE+17	1.252E+23	9.742E+06
360000.	1.327E-10	7.976E-24	3.13UE-07	2.80UE-06	4.912E-04	1.123E+12	4.524E+17	1.176E+23	1.380E+07
380000.	1.915E-10	1.113E-23	3.30UE-07	3.525E-06	7.959E-04	6.674E+11	2.734E+17	8.956E+22	1.849E+07
400000.	6.513E-10	1.605E-23	4.3UE-07	4.10UE-06	1.288E-03	3.946E+11	1.680E+17	6.858E+22	2.225E+07
420000.	7.64UE-10	2.212E-23	4.47UE-07	4.557E-06	1.995E-03	2.315E+11	1.061E+17	5.279E+22	2.756E+07
440000.	5.48UE-10	2.922E-23	5.34UE-07	4.897E-06	2.513E-03	2.09UE+11	6.859E+16	4.093E+22	2.271E+07
460000.	7.83UE-10	3.765E-23	5.50UE-07	5.15UE-06	3.947E-03	3.087E+11	4.511E+16	3.173E+22	2.05E+07
480000.	1.16UE-10	3.791E-23	7.33UE-07	6.36UE-06	3.47UE-03	5.823E+10	3.02UE+16	2.47UE+22	1.497E+07
500000.	4.419E-10	4.111E-23	5.23UE-07	5.59UE-06	3.793E-03	3.876E+10	2.05UE+16	1.93UE+22	1.568E+07
520000.	4.49UE-10	4.37UE-23	6.38UE-07	5.70UE-06	4.923E-03	2.59UE+10	1.40UE+16	1.511E+22	1.35UE+07
540000.	5.17UE-10	4.51UE-23	7.17UE-07	5.93UE-06	4.20UE-03	1.796E+10	9.649E+15	1.17UE+22	1.180E+07
560000.	5.719E-10	4.6-0E-23	7.64UE-07	6.163E-06	4.323E-03	1.20UE+10	6.644E+15	9.151E+21	1.05UE+07
580000.	5.49UE-10	4.7U7E-23	8.32UE-07	6.41UE-06	4.09UE-03	8.161E+09	4.618E+15	7.032E+21	9.162E+06
600000.	7.10UE-10	4.78UE-23	9.75UE-07	6.67UE-06	4.45UE-03	5.505E+09	3.252E+15	5.457E+21	7.98UE+06
620000.	5.681E-10	4.82UE-23	1.07UE-06	6.94UE-06	4.51UE-03	4.05UE+09	2.296E+15	4.179E+21	6.56UE+06
640000.	3.05UE-10	4.83UE-23	1.23E-06	7.21UE-06	4.54UE-03	3.132E+09	1.578E+15	3.174E+21	5.12UE+06
660000.	1.23E-09	4.83UE-23	1.2.8E-06	7.46UE-06	4.555E-03	1.852E+09	1.08UE+15	2.339E+21	5.190E+06
680000.	1.184E-09	4.837E-23	1.23UE-06	7.68UE-06	4.579E-03	1.29UE+09	7.65UE+14	1.772E+21	4.486E+06
700000.	1.425E-09	4.90UE-23	1.37UE-06	7.97UE-06	4.599E-03	8.87UE+08	5.40UE+14	1.31UE+21	3.908E+06
720000.	1.27UE-09	4.91UE-23	1.41E-06	8.23UE-06	4.69UE-03	6.12UE+08	3.97UE+14	9.54UE+20	3.47UE+06
740000.	2.222E-09	4.919E-23	1.44UE-06	8.152E-06	4.601E-03	4.20UE+08	2.937E+14	6.85UE+20	3.00UE+06
760000.	2.750E-09	4.93UE-23	1.47UE-06	8.64UE-06	4.61UE-03	3.34UE+08	2.18UE+14	4.84UE+20	2.284E+06
780000.	3.30UE-09	4.925E-23	1.50UE-06	8.84UE-06	4.617E-03	2.70UE+08	1.58UE+14	3.752E+20	1.952E+06
800000.	3.63UE-09	4.93UE-23	1.52UE-06	8.99UE-06	4.615E-03	2.19UE+08	1.04UE+14	2.77UE+20	1.002E+06

LAST ITERATION = 7

ALT	CLCL2	CLNO	CLHNO	CLH2O2	CLNO2	CLOCL	CLONO2
0.	3.211E-05	1.643E-24	1.488E-27	2.787E-06	1.206E-05	2.385E-27	1.214E-24
2000.	5.705E-05	2.193E-26	2.917E-07	2.256E-06	2.011E-05	2.705E-24	1.930E-27
4000.	5.015E-05	1.251E-27	3.279E-07	2.611E-06	2.240E-05	1.442E-21	1.306E-24
6000.	5.394E-05	3.179E-21	3.336E-07	2.804E-06	2.465E-05	2.823E-19	4.021E-24
8000.	5.651E-05	2.314E-19	3.571E-07	2.976E-06	2.573E-05	3.298E-17	7.446E-24
10000.	5.823E-05	3.883E-17	3.721E-07	3.141E-06	2.635E-05	2.540E-15	7.365E-18
12000.	5.912E-05	1.872E-15	3.818E-07	3.255E-06	2.627E-05	9.811E-14	3.358E-16
14000.	5.951E-05	5.123E-14	3.852E-07	3.318E-06	2.715E-05	2.852E-12	1.348E-14
16000.	5.736E-05	1.246E-12	3.370E-07	3.175E-06	2.715E-05	5.224E-11	2.903E-13
18000.	5.896E-05	1.340E-11	3.872E-07	3.149E-06	2.772E-05	5.182E-10	7.268E-12
20000.	5.691E-05	9.285E-11	4.217E-07	3.144E-06	2.705E-05	3.361E-09	2.332E-10
22000.	5.946E-05	4.547E-10	3.447E-07	3.215E-06	2.773E-05	1.396E-08	1.194E-10
24000.	7.492E-05	1.751E-09	3.889E-07	3.984E-06	4.817E-05	6.137E-08	4.764E-10
26000.	7.469E-05	5.554E-09	1.532E-06	3.715E-06	3.931E-05	1.438E-07	1.509E-09
28000.	7.682E-05	1.358E-08	3.214E-06	4.385E-06	3.260E-05	5.658E-07	4.348E-09
30000.	8.001E-05	3.263E-08	6.234E-06	5.410E-06	3.966E-05	1.210E-06	9.481E-09
32000.	1.172E-04	9.233E-08	1.133E-05	7.196E-06	4.944E-05	2.377E-06	1.706E-08
34000.	1.348E-04	3.234E-07	1.871E-05	8.932E-06	6.673E-05	4.038E-06	2.638E-08
36000.	1.748E-04	1.283E-07	2.312E-05	1.372E-05	8.224E-05	5.947E-06	3.591E-08
38000.	2.274E-04	1.611E-07	2.919E-05	1.956E-05	1.175E-04	7.904E-06	4.445E-08
40000.	2.883E-04	1.678E-07	3.578E-05	2.483E-05	1.432E-04	9.493E-06	5.142E-08
42000.	3.499E-04	2.033E-07	3.956E-05	3.021E-05	1.909E-04	1.070E-05	5.69.E-08
44000.	4.165E-04	2.214E-07	4.356E-05	3.551E-05	2.193E-04	1.164E-05	6.125E-08
46000.	4.503E-04	2.507E-07	4.559E-05	4.009E-05	2.327E-04	1.227E-05	6.500E-08
48000.	4.825E-04	2.463E-07	4.748E-05	4.306E-05	2.506E-04	1.277E-05	6.883E-08
50000.	5.197E-04	2.559E-07	5.038E-05	4.615E-05	2.639E-04	1.316E-05	7.381E-08
52000.	5.795E-04	2.641E-07	5.231E-05	4.990E-05	2.737E-04	1.353E-05	8.059E-08
54000.	5.432E-04	2.734E-07	5.347E-05	4.951E-05	2.309E-04	1.088E-05	8.974E-08
56000.	5.572E-04	2.842E-07	5.449E-05	5.058E-05	2.861E-04	1.423E-05	1.014E-07
58000.	5.864E-04	2.951E-07	5.647E-05	5.137E-05	2.995E-04	1.458E-05	1.151E-07
60000.	6.656E-04	3.091E-07	6.246E-05	5.137E-05	2.922E-04	1.493E-05	1.301E-07
62000.	6.690E-04	3.224E-07	6.442E-05	5.244E-05	2.940E-04	1.527E-05	1.457E-07
64000.	6.727E-04	3.357E-07	6.641E-05	5.346E-05	2.954E-04	1.561E-05	1.614E-07
66000.	6.750E-04	3.489E-07	6.832E-05	5.713E-05	2.965E-04	1.589E-05	1.773E-07
68000.	6.767E-04	3.623E-07	6.017E-05	5.736E-05	2.971E-04	1.615E-05	1.945E-07
70000.	6.780E-04	3.875E-07	6.198E-05	5.359E-05	2.976E-04	1.637E-05	2.143E-07
72000.	6.796E-04	4.104E-07	6.432E-05	5.778E-05	2.980E-04	1.654E-05	2.376E-07
74000.	6.797E-04	4.436E-07	6.273E-05	5.396E-05	2.982E-04	1.668E-05	2.629E-07
75000.	6.803E-04	4.924E-07	6.244E-05	5.412E-05	2.984E-04	1.680E-05	2.887E-07
78000.	6.807E-04	5.468E-07	6.275E-05	5.427E-05	2.985E-04	1.689E-05	3.137E-07
80000.	6.815E-04	6.071E-07	6.284E-05	5.444E-05	2.989E-04	1.696E-05	3.360E-07

LAST ITERATION + 1

ALT	CJO2	CJO3	CJCF2	CJCF3	CJO31	PREVO3	DOSINT	DMINT	PREVOH
0.	5.594E-32	2.20[illegible]E-04	8.1.6[illegible]E-30	4.025E-28	5.589E-06	7.22[illegible]E+11	8.415E+18	2.13[illegible]E+25	2.703E+06
200000.	5.149E-29	2.932E-04	1.591E-26	5.521E-25	1.119E-05	6.022E+11	8.207E+18	1.743E+25	3.372E+06
400000.	3.025E-26	3.[illegible]78E-04	1.[illegible]57E-23	3.182E-22	1.2[illegible]5E-05	4.885E+11	8.174E+18	1.367E+25	2.847E+06
600000.	5.773E-24	3.151E-04	7.398E-21	7.649E-20	1.353E-05	4.360E+11	9.081E+18	1.069E+25	2.305E+06
800000.	[illegible]322E-22	3.196E-04	7.287E-19	1.111E-17	1.453E-05	4.099E+11	7.997E+18	8.253E+24	1.459E+06
1000000.	4.251E-20	3.22[illegible]E-04	7.[illegible]32E-17	9.763E-15	1.535E-05	4.480E+11	7.911E+18	6.292E+24	8.933E+05
1200000.	1.71[illegible]E-18	3.241E-04	3.[illegible]8E-15	4.418E-14	1.588E-05	5.676E+11	7.8[illegible]9E+18	4.727E+24	5.735E+05
1400000.	4.895E-17	3.245E-04	1.258E-13	1.416E-12	1.625E-05	7.113E+11	7.681E+18	3.443E+24	3.021E+05
1600000.	8.895E-16	[illegible].2[illegible]3E-04	[illegible].3[illegible]7E-12	2.8[illegible]E-11	1.601E-05	1.30[illegible]E+12	7.474E+18	2.439E+24	4.219E+05
1800000.	8.647E-15	3.242E-04	3.0[illegible]E-11	2.980E-10	1.735E-05	7.045E+12	7.033E+18	1.747E+24	7.025E+05
2000000.	5.792E-14	3.256E-04	2.1[illegible]8E-10	2.019E-09	1.248E-05	4.049E+12	6.324E+18	1.204E+24	9.039E+05
2200000.	2.788E-13	3.298E-04	1.[illegible]89E-09	9.869E-09	2.391E-05	4.657E+12	5.452E+18	9.213E+23	1.148E+06
2400000.	1.071E-12	3.385E-04	4.32[illegible]E-09	3.78[illegible]E-08	3.[illegible]5E-05	4.990E+12	4.407E+18	6.75[illegible]E+23	1.523E+06
2600000.	3.494E-12	3.539E-04	1.470E-08	1.210E-07	4.589E-05	4.873E+12	7.501E+18	4.976E+23	2.099E+06
2800000.	3.726E-12	3.[illegible]97E-04	3.392E-08	3.230E-07	6.980E-05	4.367E+12	2.577E+18	3.613E+23	2.395E+06
3000000.	2.291E-11	4.[illegible]9E-04	5.455E-08	7.046E-07	1.179E-04	3.497E+12	1.790E+18	2.750E+23	4.416E+06
3200000.	4.645E-11	4.3[illegible]E-04	1.313E-07	1.286E-06	1.808E-04	2.012E+12	1.179E+18	2.003E+23	6.610E+06
3400000.	8.301E-11	6.119E-04	2.376E-07	2.025E-06	2.965E-04	1.770E+12	7.411E+17	1.552E+23	9.742E+06
3600000.	1.327E-10	7.281E-04	3.15[illegible]E-07	2.309E-06	4.816E-04	1.122E+12	4.519E+17	1.176E+23	1.381E+07
3800000.	1.916E-10	1.114E-03	3.305E-07	7.926E-06	7.966E-04	6.667E+11	2.731E+17	8.956E+22	1.849E+07
4000000.	2.611E-10	1.606E-03	4.307E-07	4.[illegible]9E-06	1.283E-03	3.860E+11	1.678E+17	6.853E+22	2.265E+07
4200000.	3.041E-10	2.213E-03	4.978E-07	4.557E-06	1.995E-03	2.312E+11	1.061E+17	5.278E+22	2.355E+07
4400000.	3.481E-10	2.977E-03	5.375E-07	4.937E-06	2.512E-03	1.438E+11	6.857E+16	4.083E+22	2.271E+07
4600000.	3.875E-10	3.365E-03	5.552E-07	5.158E-06	3.047E-03	9.081E+10	4.510E+16	3.173E+22	2.054E+07
4800000.	4.132E-10	3.741E-03	5.368E-07	5.768E-06	3.473E-03	5.022E+10	3.021E+16	2.473E+22	1.797E+07
5000000.	4.419E-10	4.111E-03	5.255E-07	5.594E-06	3.793E-03	3.875E+10	2.050E+16	1.934E+22	1.568E+07
5200000.	4.749E-10	4.347E-03	[illegible].535E-07	5.738E-06	4.129E-03	2.592E+10	1.404E+16	1.511E+22	1.351E+07
5400000.	5.171E-10	4.713E-03	7.187E-07	5.938E-06	4.200E-03	1.796E+10	9.648E+15	1.176E+22	1.180E+07
5600000.	5.719E-10	4.641E-03	7.344E-07	6.163E-06	4.323E-03	1.209E+10	6.643E+15	9.151E+21	1.050E+07
5800000.	6.401E-10	4.727E-03	9.520E-07	6.411E-06	4.409E-03	8.161E+09	4.618E+15	7.032E+21	9.162E+06
6000000.	7.187E-10	4.786E-03	9.7[illegible]E-07	6.676E-06	4.463E-03	5.505E+09	3.252E+15	5.457E+21	7.984E+06
6200000.	8.081E-10	4.828E-03	1.037E-06	6.947E-06	4.510E-03	4.052E+09	2.296E+15	4.179E+21	6.649E+06
6400000.	9.057E-10	4.861E-03	1.[illegible]2E-06	7.212E-06	4.542E-03	3.132E+09	1.578E+15	3.174E+21	5.129E+06
6600000.	1.023E-09	4.867E-03	1.198E-06	7.461E-06	4.565E-03	1.852E+09	1.079E+15	2.389E+21	5.190E+06
6800000.	1.184E-09	4.897E-03	1.233E-06	7.687E-06	4.573E-03	1.293E+09	7.650E+14	1.773E+21	4.480E+06
7000000.	1.425E-09	4.907E-03	1.347E-06	7.975E-06	4.599E-03	3.872E+08	5.460E+14	1.310E+21	3.908E+06
7200000.	1.774E-09	4.214E-03	1.[illegible]1E-06	8.034E-06	4.526E-03	6.120E+08	3.970E+14	9.540E+20	3.473E+06
7400000.	2.222E-09	4.319E-03	1.444E-06	8.162E-06	4.601E-03	4.207E+08	2.937E+14	6.853E+20	3.067E+06
7600000.	2.756E-09	4.923E-03	1.470E-06	8.264E-06	4.605E-03	3.305E+08	2.186E+14	4.845E+20	2.284E+06
7800000.	3.306E-09	4.925E-03	1.505E-06	8.341E-06	4.617E-03	2.703E+08	1.585E+14	3.362E+20	1.552E+06
8000000.	3.837E-09	4.933E-03	1.5[illegible]E-06	8.405E-06	4.615E-03	2.191E+08	1.096E+14	2.278E+20	1.002E+06

LAST ITERATION = 1

ALT	CLCL03	CLN2O	CLHNO3	CLH2O2	CLN2O5	CLOCL4	CLOHCL
0.	3.712E-05	1.651E-26	1.988E-07	1.731E-06	1.2..E-05	2.242E-27	1.216E-26
20000.	3.57EE-05	2.192E-26	2.517E-07	2.256E-06	2.012E-05	3.709E-24	1.939E-27
40000.	3.416E-05	1.253E-23	3.183E-07	2.9.1E-06	2.31.E-05	1.4.4E-21	1.302E-24
60000.	3.295E-05	3.041E-21	3.739E-07	3.304E-06	2.45.E-05	2.826E-19	4.024E-22
80000.	3.652E-15	4.712E-19	3.378E-07	3.346E-06	2.573E-05	3.702E-17	7.451E-20
100000.	3.024E-05	3.931E-17	3.72.E-07	3.041E-06	2.65.E-05	3.044E-15	7.368E-18
120000.	3.0.2E-05	1.873E-15	3.8.6E-07	3.396E-06	2.617E-05	8.816E-14	7.861E-16
140000.	3.95.E-15	6..26E-14	3.3.7E-07	3..18E-06	2.713E-05	2.8.4E-12	1.349E-14
160000.	3.97.E-05	1.246E-12	3.37.E-07	3..17E-06	2.7.1E-05	5.226E-11	2.904E-13
180000.	3.696E-05	4.370E-11	3.9.8E-07	3.215E-06	2.702E-05	5.281E-10	7.267E-12
200000.	3.691E-15	9.197E-11	4.218E-07	3.1.0E-06	2.735E-05	3.350E-08	2.730E-11
220000.	3.946E-05	4.5..E-10	5.173E-07	3.215E-06	2.738E-05	1.59EE-06	1..97E-10
240000.	3.(90E-06	1.72.E-09	3.836E-07	3.784E-06	2.847E-05	6.030E-08	4.76.E-10
260000.	3.469E-05	5.86.E-09	1.383E-06	3.1.7E-06	2.96.E-05	1.929E-07	1.587E-09
280000.	3.982E-05	1.5..E-08	3.218E-06	..328E-06	3.265E-05	5.256E-07	4..48E-09
300000.	3.001E-05	3.268E-08	5.205E-06	5..13E-06	3.856E-05	..21.E-06	9.481E-09
320000.	1..72E-04	5.3.5E-08	1.013E-05	7..0.E-06	4.243E-05	2.376E-06	1.746E-08
340000.	1.348E-04	9.278E-08	1.971E-05	9.837E-06	6.636E-05	..041E-06	2.639E-08
360000.	1.749E-04	1.286E-07	2.3..E-05	1..73E-06	8.223E-05	5.9.9E-06	3.5.2E-08
380000.	2.67EE-04	1.611E-07	3.319E-05	1.861E-06	1.173E-04	7.906E-06	..445E-08
400000.	2.68.E-04	1.378E-07	3..78E-05	2..33E-06	1.492E-04	9..95E-06	5.143E-08
420000.	3.198E-04	2.000E-07	3.38.E-05	3..22E-06	..809E-04	1.371E-05	5.60.E-08
440000.	4.056E-04	2.24.E-07	4.336E-05	3.561E-06	2.237E-04	1..66E-05	5..25E-08
460000.	..5.0E-04	2.367E-07	..358E-05	..009E-06	2.727E-04	1.227E-05	6.50.E-08
480000.	..85.E-04	2.460E-07	4.758E-05	..38.E-06	2.506E-04	1.277E-05	6.888E-08
500000.	3.107E-04	2.5.3E-07	5..30E-05	4.615E-06	2.641E-04	1.31.E-05	7.381E-08
520000.	..2.95E-04	2..4.E-07	5.231E-05	4.5.8E-06	2.737E-04	1..53E-05	8..54E-08
540000.	3.473E-04	2.774E-07	5.3.7E-05	..051E-06	2.3..E-04	1.388E-05	8.974E-08
560000.	..532E-04	2.342E-07	..4.2E-05	5.056E-06	2.96.E-04	1.423E-05	1.4.4E-07
580000.	3.6.4E-04	2.96.E-07	5.347E-05	5.137E-06	3.096E-04	1.45.E-05	1.151E-07
600000.	3.656E-04	3..91E-07	5.3.4E-05	5.187E-06	2.322E-04	1.49.E-05	1.3.1E-07
620000.	3.695E-04	3.22.E-07	5.442E-05	5.244E-06	2.3..E-04	1.527E-05	1.457E-07
640000.	3.727E-04	3.35/E-07	5.4..E-05	5.28..E-06	..954E-04	1.560E-05	1.614E-07
660000.	5.750E-04	3.489E-07	5.472E-05	5.32.E-06	2.965E-04	1.589E-05	1.773E-07
680000.	3.767E-04	3.623E-07	5.917E-05	5.378E-06	2.971E-04	1.615E-05	1.945E-07
700000.	3.780E-04	3.0.5E-07	6.0.4E-05	5.359E-06	2.976E-04	1.637E-05	2.143E-07
720000.	3.79.E-04	..064E-07	6.152E-05	5..78E-06	2.380E-04	..65.E-05	2.372E-07
740000.	3.799E-04	4.476E-07	6.203E-05	5.39EE-06	2.382E-04	1.669E-05	2.625E-07
760000.	3.807E-04	4.324E-07	6.244E-05	5.412E-06	2.9..E-04	1.680E-05	2.887E-07
780000.	3.807E-04	5.489E-07	6.275E-05	5.427E-06	2.983E-04	1.689E-05	3.137E-07
800000.	3.815E-04	5.97.E-07	6.3..E-05	5.444E-06	2.983E-04	1.696E-05	3.364E-07

K	ALT	H	OH	HO2	H2O2	O	O3	O3INT	O(D)
1	0.	3.2455E-01	2.7033E+06	9.5321E+08	1.6860E+11	2.7378E+03	7.2253E+11	8.4104E+18	9.8849E-03
2	200000.	3.2819E-01	2.7217E+06	9.1059E+08	1.1874E+11	2.9089E+03	6.0225E+11	8.2829E+18	9.9872E-03
3	400000.	3.1467E-01	2.8472E+06	7.5105E+08	7.5654E+10	3.8470E+03	4.8349E+11	8.1779E+18	1.2235E-02
4	600000.	2.3523E-01	2.3146E+06	5.0187E+08	4.4437E+10	4.9341E+03	4.3577E+11	8.1813E+18	1.4769E-02
5	800000.	1.5522E-01	4.4599E+06	3.8695E+08	1.9327E+10	6.3984E+03	4.0992E+11	7.9967E+18	1.7991E-02
6	1000000.	9.3512E-02	3.3337E+06	2.5307E+08	7.7439E+09	9.7083E+03	4.4836E+11	7.9108E+18	2.5141E-02
7	1200000.	5.7949E-02	5.7347E+06	1.5846E+08	2.7340E+09	1.7915E+04	5.6757E+11	7.8097E+18	4.0431E-02
8	1400000.	4.7753E-02	5.3213E+06	8.6578E+07	7.0317E+08	2.5190E+04	7.1130E+11	7.6814E+18	5.8561E-02
9	1600000.	3.4297E-02	4.2188E+06	7.0656E+07	6.6105E+08	9.4378E+04	1.3616E+12	7.4741E+18	1.6370E-01
10	1800000.	6.4800E-02	7.1245E+06	8.4723E+07	9.7460E+08	4.5586E+05	3.0449E+12	7.0334E+18	5.5893E-01
11	2000000.	1.2642E-01	9.3331E+05	9.4790E+07	1.2450E+09	1.2920E+06	4.0489E+12	6.3240E+18	1.1903E+00
12	2200000.	1.7795E-01	1.1434E+06	1.3621E+08	1.5885E+09	2.0757E+06	4.6367E+12	5.4525E+18	2.3783E+00
13	2400000.	3.4680E-01	1.5246E+06	1.1511E+08	1.8353E+09	6.7185E+06	4.9890E+12	4.4860E+18	4.7421E+00
14	2600000.	7.0227E-01	2.3394E+06	1.2428E+08	1.8690E+09	1.3829E+07	4.8728E+12	3.5006E+18	9.3119E+00
15	2800000.	2.0437E+00	2.3347E+06	1.2485E+08	1.5955E+09	2.6114E+07	4.5567E+12	2.5766E+18	1.7560E+01
16	3000000.	6.0032E+00	4.1502E+06	1.1605E+08	1.0093E+09	4.7444E+07	3.4367E+12	1.7943E+18	3.0728E+01
17	3200000.	2.0155E+01	6.5095E+06	3.9859E+07	6.0147E+08	7.9079E+07	2.5124E+12	1.1794E+18	5.1238E+01
18	3400000.	7.3711E+01	2.4424E+06	7.8237E+07	2.6865E+08	1.2722E+08	1.7703E+12	7.4113E+17	7.7858E+01
19	3600000.	2.7429E+02	1.3303E+07	5.7814E+07	1.0763E+08	1.9861E+08	1.1216E+12	4.5194E+17	1.0885E+02
20	3800000.	1.0053E+03	1.3432E+07	4.2367E+07	4.7654E+07	3.0779E+08	6.0605E+11	2.7311E+17	1.4448E+02
21	4000000.	3.3374E+03	2.2751E+07	3.2558E+07	2.0775E+07	4.7319E+08	3.8524E+11	1.6762E+17	1.8173E+02
22	4200000.	9.5212E+03	2.3055E+07	2.6813E+07	1.2155E+07	7.1007E+08	2.7124E+11	1.1607E+17	2.1357E+02
23	4400000.	2.7356E+04	2.2730E+07	2.2863E+07	8.0515E+06	1.0147E+09	1.4383E+11	6.8566E+16	2.3331E+02
24	4600000.	4.9684E+04	2.0542E+07	1.9346E+07	5.5590E+06	1.3052E+09	9.0810E+10	4.5102E+16	2.3603E+02
25	4800000.	3.2665E+04	1.7958E+07	1.6762E+07	3.8774E+06	1.6893E+09	5.3219E+10	3.0200E+16	2.2485E+02
26	5000000.	1.5489E+05	1.5307E+07	1.3947E+07	2.7600E+06	1.9973E+09	3.3749E+10	2.0503E+16	2.0916E+02
27	5200000.	2.4316E+05	1.3779E+07	1.1639E+07	1.9405E+06	2.2786E+09	2.5319E+10	1.4036E+16	1.8921E+02
28	5400000.	3.6391E+05	1.2727E+07	1.0152E+07	1.4008E+06	2.3597E+09	1.7152E+10	9.6482E+15	1.7181E+02
29	5600000.	5.4219E+05	1.0504E+07	8.9308E+06	1.0536E+06	2.7707E+09	1.2089E+10	6.6433E+15	1.5017E+02
30	5800000.	7.9216E+05	9.1524E+06	7.6977E+06	7.0300E+05	2.9038E+09	8.1606E+09	4.6183E+15	1.3078E+02
31	6000000.	1.1391E+06	7.3378E+06	5.6206E+06	5.4921E+05	3.1974E+09	5.5149E+09	3.2518E+15	1.1311E+02
32	6200000.	1.5950E+06	6.5416E+06	5.3862E+06	3.4534E+05	3.5828E+09	4.0516E+09	2.2962E+15	1.0518E+02
33	6400000.	2.0779E+06	5.1236E+06	4.6026E+06	1.8096E+05	4.2741E+09	3.1316E+09	1.5778E+15	1.0310E+02
34	6600000.	2.3842E+06	5.1240E+06	4.1090E+06	1.7802E+05	3.3972E+09	1.8519E+09	1.0795E+15	7.7656E+01
35	6800000.	4.1651E+06	4.4375E+06	3.4744E+06	1.1992E+05	4.2717E+09	1.2334E+09	7.6496E+14	6.9144E+01
36	7000000.	6.1284E+06	3.9073E+06	2.9461E+06	7.9534E+04	4.6300E+09	8.8724E+08	5.4690E+14	6.1455E+01
37	7200000.	9.2327E+06	3.4735E+06	2.5319E+06	5.4238E+04	5.4211E+09	6.1203E+08	3.9698E+14	5.5074E+01
38	7400000.	1.4013E+07	3.0555E+06	2.1481E+06	3.6815E+04	5.7141E+09	4.2366E+08	2.9371E+14	4.9559E+01
39	7600000.	1.9906E+07	2.2936E+06	1.4524E+06	1.4939E+04	7.7941E+09	3.7454E+08	2.1859E+14	5.1446E+01
40	7800000.	2.6478E+07	1.5315E+06	8.5047E+05	4.7007E+03	1.0103E+10	2.7034E+08	1.5850E+14	5.6106E+01
41	8000000.	3.2959E+07	1.7018E+06	4.6400E+05	1.2361E+03	1.7915E+10	2.1912E+08	1.0956E+14	6.1352E+01

K	ALT	NO	NO2	HNO3	NO3	N2O5	NOX
1	0.	6.8983E+08	2.1862E+09	3.9643E+10	4.4290E+06	7.1223E+08	4.4917E+10
2	39663.	7.6673E+08	2.7201E+09	1.9737E+11	1.1436E+06	5.1676E+07	2.1740E+11
3	79800.	5.9728E+08	4.6543E+09	8.7651E+09	2.7737E+05	4.8408E+06	9.7841E+09
4	119600.	3.8895E+08	2.1062E+09	4.2411E+09	8.3523E+04	6.7467E+05	4.8520E+09
5	159400.	2.7472E+08	1.0001E+09	2.3468E+09	3.0102E+04	1.3907E+05	2.8546E+09
6	199200.	2.0131E+08	1.2675E+08	1.4609E+09	1.4014E+04	5.9506E+04	1.9528E+09
7	239000.	5.8527E+08	1.3595E+09	1.5947E+09	2.2974E+04	9.8197E+04	2.2885E+09
8	278800.	1.8107E+08	1.3269E+08	1.5122E+09	1.1167E+04	7.0132E+04	2.7273E+09
9	318600.	1.2787E+08	7.0498E+08	3.0675E+09	2.2424E+04	2.1428E+05	4.7639E+09
10	358400.	8.1125E+08	5.8546E+08	8.3853E+09	1.2856E+05	2.4730E+06	9.9928E+09
11	398200.	6.9633E+08	5.4266E+08	1.0221E+10	2.3647E+05	7.4753E+06	1.2151E+10
12	438000.	6.5113E+08	1.0733E+09	1.0836E+10	5.4572E+05	1.6021E+07	1.2398E+10
13	477800.	7.3787E+08	1.4456E+09	9.8026E+09	9.1226E+05	2.3777E+07	1.1630E+10
14	517600.	3.7345E+08	2.0367E+09	6.5045E+09	1.2944E+06	2.3884E+07	1.0234E+10
15	557400.	1.2 [illegible]E+09	[illegible]E+09	4.2172E+09	2.2978E+ 6	1.0794E+08	8.6633E+09
16	597200.	1.4296E+09	2.3235E+09	2.4496E+09	2.2365E+06	8.7555E+07	7.0680E+09
17	637000.	1.5344E+09	2.4172E+09	1.6307E+09	1.7806E+06	6.7906E+07	5.5949E+09
18	676800.	1.5022E+09	2.3918E+09	7.2956E+08	1.1652E+06	4.4187E+07	4.3485E+09
19	716600.	1.5194E+09	1.8712E+09	3.5747E+08	6.2934E+05	3.7870E+06	3.2580E+09
20	756400.	1.3734E+09	8.1947E+08	1.6825E+08	2.7844E+05	5.7759E+05	2.4305E+09
21	796200.	1.2977E+09	4.3867E+08	5.4514E+07	1.0359E+05	7.4156E+04	1.7366E+09
22	836000.	1.2921E+09	2.3756E+08	2.0414E+07	3.3141E+04	7.9625E+03	1.3196E+09
23	875800.	1.2632E+09	1.1621E+08	9.6145E+06	1.1209E+04	7.7636E+02	9.6510E+08
24	915600.	6.0647E+08	5.8477E+07	1.4329E+06	3.5430E+03	7.3427E+01	7.6392E+08
25	955400.	4.9867E+08	1.5720E+07	7.8426E+05	1.0732E+03	8.9394E+00	5.1466E+08
26	995200.	3.7639E+08	5.3475E+06	1.3966E+05	3.7804E+02	6.4495E-01	3.7956E+08
27	1035000.	2.7673E+08	1.8021E+06	3.1510E+04	8.5195E+01	5.9644E-02	2.7948E+08
28	1074800.	2.0534E+08	6.2595E+05	9.0549E+03	2.2221E+01	5.2241E-03	2.0643E+08
29	1114600.	1.5067E+08	2.1852E+05	2.9720E+03	5.9239E+00	4.3465E-04	1.5146E+08
30	1154400.	1.1081E+08	7.5385E+04	8.9539E+02	1.5827E+00	3.4832E-05	1.1094E+08
31	1194200.	7.8499E+07	2.6477E+04	2.6150E+02	3.1856E-01	2.5732E-06	7.8550E+07
32	1234000.	5.0624E+07	9.2345E+03	7.9730E+01	7.0791E-02	1.8607E-07	5.0727E+07
33	1273800.	3.3779E+07	3.1912E+03	2.9804E+01	1.5948E-02	1.2892E-08	3.3756E+07
34	1313600.	2.2485E+07	1.0973E+03	8.6788E+00	2.4906E-03	5.5876E-10	2.2503E+07
35	1353400.	1.5670E+07	3.3474E+02	1.6965E+00	4.3477E-04	2.7759E-11	1.5688E+07
36	1393200.	1.0269E+07	1.0394E+02	4.2436E-01	6.8639E-05	1.1144E-12	1.0278E+07
37	1433000.	7.8403E+06	3.1771E+01	1.0477E-01	1.0159E-05	4.3097E-14	7.8617E+06
38	1472800.	5.8515E+06	9.2314E+00	2.4004E-02	1.3687E-06	1.2134E-15	5.8668E+06
39	1512600.	2.8857E+06	1.7606E+00	4.4179E-03	1.9704E-07	3.0087E-17	2.9005E+06
40	1552400.	1.5436E+06	3.5965E+00	6.8747E-04	2.5238E-08	6.0854E-19	1.5564E+06
41	1592200.	8.9750E+05	1.1479E+00	9.3714E-05	2.9789E-09	1.8057E-20	9.0771E+05

K	ALT	CL	CLO	HCL	CLNO3	OCLX
1	0.	9.7579E+03	4.1473E-16	5.9587E+06	2.4032E-13	2.3206E+10	9.5249E-10	1.0836E+09	4.4943E-11	1.1000E-09
2	2.0049.	9.1117E+03	7.8535E-16	3.5681E+06	1.6351E-13	1.2383E+10	5.8826E-10	1.9895E+08	9.4515E-12	5.7000E-10
3	40000.	5.4610E+03	3.3077E-16	2.6274E+06	1.5914E-13	6.0729E+09	3.5782E-10	5.0732E+07	3.0728E-12	3.1000E-10
4	60000.	3.4117E+03	2.3461E-16	1.9727E+06	1.4707E-13	3.2831E+09	2.4277E-10	1.6706E+07	1.2507E-12	1.7000E-10
5	80000.	2.0094E+03	1.3482E-16	1.0314E+06	9.9394E-14	1.9856E+09	1.8259E-10	5.7476E+06	5.2827E-13	1.2000E-10
6	100000.	1.2438E+03	1.4247E-16	6.7345E+05	7.7116E-14	1.2764E+09	1.4616E-10	2.8083E+06	3.2158E-13	8.4100E-11
7	120000.	7.2321E+02	1.7823E-16	5.2345E+05	7.4270E-14	1.2036E+09	1.7411E-10	2.9188E+06	4.2222E-13	1.1000E-10
8	140000.	9.8696E+02	1.8540E-16	4.7469E+05	9.6246E-14	1.1718E+09	1.9757E-10	2.5725E+06	4.3373E-13	1.3040E-10
9	160000.	7.5021E+02	5.1984E-16	1.2014E+06	2.0292E-13	1.2326E+09	3.0042E-10	1.4873E+07	3.6248E-12	2.4000E-10
10	180000.	7.2088E+02	2.6726E-15	1.1074E+07	3.9212E-12	1.5375E+09	5.6567E-10	1.7264E+08	6.1149E-11	6.0000E-10
11	200000.	1.2258E+04	6.1205E-15	2.8494E+07	1.4247E-11	1.4702E+09	7.3508E-10	3.8502E+08	1.9251E-10	9.5000E-10
12	220000.	1.5806E+04	1.1833E-14	4.8574E+07	3.3389E-11	1.1711E+09	8.1684E-10	5.5873E+08	3.7700E-10	1.3000E-09
13	240000.	2.2677E+04	2.1974E-14	8.3315E+07	6.1352E-11	8.6776E+08	8.3698E-10	8.0934E+08	5.9044E-10	1.6000E-09
14	260000.	3.8827E+04	4.1401E-14	6.555.E+07	8.9399E-11	6.3532E+08	8.5335E-10	5.6845E+08	7.6354E-10	1.8000E-09
15	280000.	4.8522E+04	5.0934E-14	8.9336E+07	1.0767E-10	4.7956E+08	8.8265E-10	4.6896E+08	8.6402E-10	2.0000E-09
16	300000.	7.5588E+04	1.1020E-13	7.7023E+07	1.9401E-10	3.4446E+08	9.6825E-10	3.3016E+08	8.3163E-10	2.2000E-09
17	320000.	1.3188E+05	4.5034E-13	3.1915E+07	3.4435E-10	3.4165E+08	1.0659E-09	2.0219E+08	6.9147E-10	2.3004E-09
18	340000.	2.3473E+05	1.4870E-12	1.2544E+08	4.8839E-10	2.5418E+08	1.1772E-09	9.8280E+07	4.5521E-10	2.3000E-09
19	360000.	3.9537E+05	2.4581E-12	4.7911E+08	6.7277E-10	2.0391E+08	1.2457E-09	3.7060E+07	2.3105E-10	2.4000E-09
20	380000.	5.1732E+05	5.1523E-12	9.3306E+07	7.8789E-10	1.5432E+08	1.2886E-09	1.0554E+07	8.8101E-11	2.4000E-09
21	400000.	8.6098E+05	9.6656E-12	6.8820E+07	7.7537E-10	1.2312E+08	1.3679E-09	2.2808E+06	2.5434E-11	2.4000E-09
22	420000.	1.4316E+06	1.5668E-11	4.9215E+07	6.5777E-10	1.0229E+08	1.5048E-09	4.4206E+05	5.9144E-12	2.4000E-09
23	440000.	1.1057E+06	2.1412E-11	2.5463E+07	4.9225E-10	8.6256E+07	1.5715E-09	6.0881E+04	1.1796E-12	2.4000E-09
24	460000.	1.1695E+06	2.7145E-11	1.3157E+07	3.3435E-10	7.1945E+07	1.8265E-09	8.5071E+03	2.1597E-13	2.4000E-09
25	480000.	9.5917E+05	3.1614E-11	6.5574E+06	2.1639E-10	5.8895E+07	1.9405E-09	1.2224E+03	4.0278E-14	2.4000E-09
26	500000.	8.2476E+05	3.5132E-11	3.3566E+06	1.4151E-10	4.7732E+07	2.0123E-09	1.9867E+02	8.3755E-15	2.4000E-09
27	520000.	7.1019E+05	3.7965E-11	1.7281E+06	9.1720E-11	3.8309E+07	2.0596E-09	7.3350E+01	1.7930E-15	2.4000E-09
28	540000.	5.2324E+05	4.0336E-11	9.0122E+05	6.1138E-11	3.0714E+07	2.0888E-09	6.1756E+00	4.1982E-16	2.4000E-09
29	560000.	4.3179E+05	4.2277E-11	4.6838E+05	4.1408E-11	2.4418E+07	2.1068E-09	1.1164E+00	9.6325E-17	2.4000E-09
30	580000.	4.0236E+05	4.4191E-11	2.4109E+05	2.6425E-11	1.9235E+07	2.1191E-09	1.9820E-01	2.1768E-17	2.4000E-09
31	600000.	3.2712E+05	4.5730E-11	1.2384E+05	1.7717E-11	1.5195E+07	2.1267E-09	3.5067E-02	4.9087E-18	2.4000E-09
32	620000.	2.6717E+05	4.7405E-11	6.9235E+04	1.1752E-11	1.2008E+07	2.1307E-09	6.7217E-03	1.1926E-18	2.4000E-09
33	640000.	2.2011E+05	4.8845E-11	3.5474E+04	8.0730E-12	9.4148E+06	2.1320E-09	1.2593E-03	2.8517E-19	2.4000E-09
34	660000.	1.7045E+05	4.9782E-11	1.9768E+04	5.1557E-12	7.3377E+06	2.1350E-09	2.0312E-04	5.9133E-20	2.4000E-09
35	680000.	1.3665E+05	5.1786E-11	9.1027E+03	3.4295E-12	5.6838E+06	2.1351E-09	3.3777E-05	1.2688E-20	2.4000E-09
36	700000.	1.0826E+05	5.3425E-11	4.4216E+03	2.2706E-12	4.3240E+06	2.1343E-09	4.9573E-06	2.4468E-21	2.4000E-09
37	720000.	8.0520E+04	5.6143E-11	2.2435E+03	1.4437E-12	3.2773E+06	2.1324E-09	7.0139E-07	4.5693E-22	2.4000E-09
38	740000.	6.0609E+04	5.7604E-11	1.0835E+03	9.4056E-13	2.4539E+06	2.1294E-09	9.2689E-08	8.0460E-23	2.4000E-09
39	760000.	4.1093E+04	7.1423E-11	5.8191E+02	5.8128E-13	1.8116E+06	2.1178E-09	1.2767E-08	1.4926E-23	2.4000E-09
40	780000.	2.1590E+04	2.6465E-11	2.4314E+02	2.4032E-13	1.3146E+06	2.0929E-09	1.7916E-09	2.8524E-24	2.4000E-09
41	800000.	5.2747E+04	1.4563E-10	2.1357E+02	4.8193E-13	9.3117E+05	2.0478E-09	2.5122E-10	5.5140E-25	2.4000E-09

K	ALT	H + O3	OH + O3	HO2 + O3	HO2 + O	OH + O	NO2 + O	CLO + O	O + O3	O2 + HV
1	0.	5.7904E+00	1.1155E+00	4.6328E+05	1.7740E+04	2.9140E-01	9.2319E+01	1.4863E+00	4.0837E+01	5.3865E-13
2	2000000.	2.2240E+00	5.7443E+04	2.8314E+05	1.2411E+02	4.0322E-01	3.5916E+01	1.1113E+00	3.0468E+01	5.1698E-10
3	4000000.	4.0001E+00	5.5887E+04	1.5185E+03	1.2360E+02	4.6955E-01	3.0068E+01	4.0173E+00	2.3259E+01	1.9952E-07
4	6000000.	2.3014E+00	3.4027E+04	8.0078E+04	1.1823E+02	4.6828E-01	1.3803E+01	9.4771E+01	1.9224E+01	3.0812E-05
5	8000000.	1.2594E+00	2.3593E+04	3.7751E+04	9.6611E+01	3.6425E-01	1.6042E+01	6.4256E-01	1.4914E+01	2.7491E-03
6	10000000.	2.1439E+00	8.2127E+03	1.8639E+04	9.0347E+01	3.1897E-01	1.9076E+01	5.7346E-01	1.4998E+01	1.4842E-01
7	12000000.	8.5459E-01	4.9151E+03	1.0059E+04	9.7997E+01	7.3981E-01	4.4758E+01	7.2944E-01	1.9228E+01	4.7507E+00
8	14000000.	5.1268E-01	2.3574E+03	4.3467E+03	8.8146E+01	2.4731E-01	9.2704E+01	5.3266E-01	1.8742E+01	1.1644E+02
9	16000000.	1.2222E+00	5.2322E+03	5.7193E+03	2.0051E+02	1.1078E+00	5.4221E+02	8.4629E+00	9.2170E+01	1.4595E+03
10	18000000.	5.1752E+00	2.1605E+04	1.6573E+04	1.2128E+03	1.1145E+01	2.4254E+03	3.8786E+02	1.2567E+03	9.9972E+03
11	20000000.	1.7809E+01	6.1405E+04	2.8610E+04	3.3211E+03	7.7701E+01	2.0654E+04	2.8537E+03	5.7910E+03	4.6366E+04
12	22000000.	2.1594E+01	6.7247E+04	4.2478E+04	1.0270E+04	1.1696E+02	6.3171E+04	1.1895E+04	1.9695E+04	1.5946E+05
13	24000000.	4.1992E+01	1.3529E+05	8.5095E+04	2.6593E+04	2.4327E+02	1.8198E+05	3.4323E+04	5.2596E+04	4.4263E+05
14	26000000.	1.0033E+02	1.9772E+05	5.6392E+04	5.9412E+04	3.0279E+02	5.3186E+05	7.5834E+04	1.2946E+05	1.0414E+06
15	28000000.	2.7483E+02	3.1596E+05	9.0479E+04	1.1406E+05	2.7750E+02	1.2777E+06	1.5136E+05	2.5867E+05	2.1106E+06
16	30000000.	5.9906E+02	3.7725E+05	5.6362E+04	1.8709E+05	2.1134E+02	2.3337E+06	2.9727E+05	4.2154E+05	3.6383E+06
17	32000000.	1.3698E+03	3.3011E+05	2.1045E+04	2.7414E+05	1.0143E+02	3.4349E+06	6.0289E+05	6.1466E+05	5.4298E+06
18	34000000.	3.3968E+03	2.2701E+05	2.4378E+04	3.5172E+05	4.3708E+01	4.4117E+06	1.1736E+06	7.9695E+05	7.1634E+06
19	36000000.	7.3389E+03	1.5190E+05	1.3892E+04	4.1491E+05	9.0816E+01	4.9201E+06	1.8383E+06	9.3612E+05	8.5112E+06
20	38000000.	1.7423E+04	7.1423E+05	6.3133E+03	4.7862E+05	2.1838E+02	4.3904E+06	2.5321E+06	1.0162E+06	9.1775E+06
21	40000000.	3.3515E+04	2.7827E+05	3.1602E+03	5.7872E+05	7.9470E+02	3.7845E+06	2.9323E+06	1.0632E+06	9.0341E+06
22	42000000.	5.7437E+04	1.6308E+05	1.7378E+03	7.2312E+05	6.3756E+03	2.6975E+06	2.8636E+06	1.1134E+06	8.2672E+06
23	44000000.	8.7367E+04	1.0752E+05	1.0210E+03	9.0002E+05	3.9785E+04	2.0857E+06	2.3617E+06	1.1474E+06	7.1846E+06
24	46000000.	1.2173E+05	6.3224E+04	6.0536E+02	1.0362E+06	1.0932E+05	9.4925E+05	1.6581E+06	1.1566E+06	6.0420E+06
25	48000000.	1.6027E+05	3.8501E+04	3.5140E+02	1.1434E+06	1.2106E+06	4.3950E+05	1.0418E+06	9.8287E+05	5.0164E+06
26	50000000.	2.5335E+05	2.2331E+04	2.3914E+02	1.1105E+06	1.2485E+06	2.5289E+05	6.2930E+05	7.7311E+05	4.1329E+06
27	52000000.	3.5768E+05	1.2708E+04	1.1046E+02	1.0702E+06	1.2435E+06	1.2431E+05	3.6417E+05	5.8352E+05	3.5332E+06
28	54000000.	4.6327E+05	7.2711E+03	6.2073E+01	1.0160E+06	1.1806E+06	5.9827E+04	2.1250E+05	3.9609E+05	3.0422E+06
29	56000000.	1.7042E+05	4.0714E+03	3.2376E+01	9.5358E+05	1.1216E+06	2.7409E+04	1.1812E+05	2.5597E+05	2.6512E+06
30	58000000.	1.5008E+05	2.4473E+03	1.7529E+01	8.7577E+05	1.0427E+06	1.2430E+04	6.4772E+04	1.6522E+05	2.3312E+06
31	60000000.	1.3302E+05	1.2721E+03	9.4768E+00	7.9336E+05	9.5573E+05	5.4772E+03	3.5076E+04	1.0287E+05	2.0567E+06
32	62000000.	1.5381E+05	7.2721E+02	4.9349E+00	7.2235E+05	8.6592E+05	2.4777E+03	2.0532E+04	6.5983E+04	1.8217E+06
33	64000000.	1.6943E+05	3.8906E+02	2.1721E+00	6.9460E+05	7.8956E+05	1.1571E+03	1.2695E+04	4.6305E+04	1.5999E+06
34	66000000.	1.3695E+05	1.7487E+02	1.0774E+00	5.4631E+05	6.9910E+05	5.8408E+02	5.6348E+03	1.8856E+04	1.4052E+06
35	68000000.	1.4073E+05	8.9360E+01	5.4275E-01	4.3295E+05	6.2353E+05	1.4995E+02	3.0394E+03	1.0527E+04	1.2610E+06
36	70000000.	1.4127E+05	4.2341E+01	2.3697E-01	4.3241E+05	5.7758E+05	5.4886E+01	1.5898E+03	5.7240E+03	1.1548E+06
37	72000000.	1.4692E+05	2.3137E+01	1.2344E-01	3.9469E+05	5.4137E+05	1.3401E+01	8.3641E+02	3.0863E+03	1.0869E+06
38	74000000.	1.7327E+05	1.1697E+01	4.8948E-02	3.8773E+05	5.1259E+05	4.9475E+00	4.3897E+02	1.6307E+03	1.0238E+06
39	76000000.	1.7126E+05	5.4703E+00	1.9351E-02	2.9069E+05	4.6951E+05	2.3853E+00	2.9254E+02	1.1111E+03	9.4098E+05
40	78000000.	1.4009E+05	2.2576E+00	6.9464E-03	2.2882E+05	4.1454E+05	8.9475E-01	1.2535E+02	8.0614E+02	8.3848E+05
41	80000000.	1.3775E+05	9.9305E-01	2.1015E-03	1.6150E+05	3.4908E+05	2.8274E-01	1.8908E+02	5.6407E+02	6.9928E+05

INTEGRATED LOSS FOR OZONE

	4.2906E+11	5.9520E+11	8.5518E+10	3.0197E+12	3.6765E+12	5.3669E+12	3.8006E+12	2.4182E+12	1.9774E+13

K	ALT	H2O + HV	O2 + O1D	CH4 + O1D	HNO3 + HV	CO + OH	NO + HO2	JH2O2+H2O2	CL + CH4
1	0.	1.4189E+01	1.5143E+06	5.9592E+01	5.9007E+03	2.3548E+05	2.7354E+05	4.4862E+05	4.1093E+04
2	200000.	2.0e09E+01	1.0310E+06	8.7724E+01	5.156vE+03	8.6989E+05	2.4946E+05	5.3571E+05	2.3793E+04
3	400000.	1.9864E+01	6.4178E+05	8.3320E+01	2.6943E+03	5.905vE+05	1.2256E+05	3.9353E+05	1.0387E+04
4	600000.	1.9702E+01	3.7044E+05	8.1692E+01	1.4289E+03	3.6226E+05	5.8314E+04	2.4922E+05	4.3242E+03
5	800000.	1.9145E+01	1.1737E+05	8.0624E+01	8.3967E+02	1.7416E+05	3.0414E+04	1.1387E+05	1.5841E+03
6	1000000.	2.1430E+01	4.1454E+04	8.0742E+01	5.4586E+02	8.0704E+04	1.5361E+04	4.7097E+04	5.8532E+02
7	1200000.	2.7190E+01	2.4216E+04	1.1367E+02	5.9557E+02	7.7004E+04	1.1896E+04	1.5925E+04	3.2898E+02
8	1400000.	3.3588E+01	3.3639E+03	2.4027E+02	5.8211E+02	1.5428E+04	8.3235E+03	4.3854E+03	1.5531E+02
9	1600000.	5.4031E+01	1.3259E+03	2.6625E+02	1.3076E+03	9.4074E+03	6.0319E+03	4.1209E+03	2.1444E+02
10	1800000.	1.4171E+02	3.1198E+02	5.7758E+02	3.2989E+03	7.5257E+03	6.0775E+03	6.4722E+03	4.6731E+02
11	2000000.	6.0007E+02	4.9332E+01	7.9502E+02	4.3050E+03	8.9712E+03	8.4522E+03	7.8213E+03	5.5515E+02
12	2200000.	2.6964E+03	6.7487E+00	1.0220E+03	5.1938E+03	4.1883E+03	7.5318E+03	1.0025E+04	5.5358E+02
13	2400000.	7.7034E+03	9.5518E+00	1.3076E+03	6.9407E+03	3.0196E+03	9.9655E+03	1.2425E+04	5.1935E+02
14	2600000.	2.1974E+04	1.3389E+01	1.6167E+03	1.0026E+04	4.1832E+03	1.4773E+04	1.3819E+04	5.0100E+02
15	2800000.	7.1178E+04	1.8738E+01	1.8933E+03	1.3563E+04	4.8174E+03	2.0576E+04	1.5811E+04	5.0809E+02
16	3000000.	2.0458E+05	2.6311E+01	2.0224E+03	1.5364E+04	5.7387E+03	2.4612E+04	1.1792E+04	5.6376E+02
17	3200000.	1.0646E+05	2.3574E+01	2.0242E+03	1.4822E+04	6.7776E+03	2.4238E+04	8.6284E+03	6.4641E+02
18	3400000.	1.1201E+05	2.3182E+01	2.0093E+03	1.2122E+04	7.6655E+03	2.4954E+04	5.3362E+03	7.5165E+02
19	3600000.	1.0731E+05	2.4434E+01	1.4706E+03	8.4575E+03	9.0562E+03	1.6349E+04	2.9538E+03	8.1453E+02
20	3800000.	3.6624E+04	3.4106E+01	1.1674E+03	4.9118E+03	7.8689E+03	1.2220E+04	1.6243E+03	8.0966E+02
21	4000000.	8.3310E+02	3.7283E+01	8.2494E+02	2.2442E+03	6.8794E+03	9.1305E+03	1.0107E+03	7.2175E+02
22	4200000.	8.9756E+02	2.9360E+01	5.7732E+02	8.8836E+02	5.4173E+03	6.8352E+03	7.3436E+02	5.6777E+02
23	4400000.	5.6223E+02	2.7753E+01	3.9006E+02	2.4606E+03	4.3479E+03	4.9365E+03	5.7338E+02	4.0764E+02
24	4600000.	3.0872E+06	1.3553E+01	2.9833E+02	6.8306E+01	2.9467E+03	3.4369E+03	4.4542E+02	2.7633E+02
25	4800000.	4.9785E+02	1.7471E+01	1.8513E+02	1.8860E+01	2.1765E+03	2.2762E+03	3.3779E+02	1.7900E+02
26	5000000.	5.5538E+02	9.7436E+00	1.0979E+02	5.5586E+00	1.6626E+03	1.4516E+03	2.5476E+02	1.1131E+02
27	5200000.	5.5479E+02	6.9472E+00	7.7308E+01	1.6483E+00	1.2348E+03	8.9935E+02	1.8745E+02	6.8309E+01
28	5400000.	1.7245E+02	4.2883E+00	5.0588E+01	5.1656E+01	1.0450E+03	5.4334E+02	1.3870E+02	4.1729E+01
29	5600000.	8.6617E+02	3.4357E+00	3.3953E+01	1.6196E-01	8.6062E+02	3.3108E+02	1.0658E+02	2.4163E+01
30	5800000.	3.1709E+02	2.3316E+00	2.2854E+01	4.9149E+00	5.9.46E+02	1.9387E+02	7.8395E+01	1.4215E+01
31	6000000.	9.6019E+02	1.5931E+00	1.5349E+01	1.4703E-02	5.4380E+02	1.1297E+02	5.7085E+01	8.2257E+00
32	6200000.	7.7148E+02	1.0830E+00	1.1190E+01	4.3497E-03	4.0540E+02	5.8474E+01	3.6218E+01	4.5391E+00
33	6400000.	3.0416E+02	6.9057E+01	8.5922E+00	1.1600E-03	2.6445E+02	2.7081E+01	1.9118E+01	2.4924E+00
34	6600000.	6.6292E+02	3.6537E+02	5.0345E+00	3.7246E-04	2.1385E+02	1.6910E+01	1.8917E+01	1.2686E+00
35	6800000.	6.3236E+02	1.9837E+02	3.4880E+00	1.0209E-04	1.4077E+02	9.3861E+00	1.2706E+01	6.5672E-01
36	7000000.	7.8187E+02	1.0119E+02	2.3306E+00	2.5845E-05	5.6261E+02	4.0122E+00	8.5241E+00	3.2671E-01
37	7200000.	3.1956E+02	5.2353E+01	1.5810E+00	6.4202E-06	7.4246E+02	1.8757E+00	5.8338E+00	1.6024E-01
38	7400000.	8.7756E+02	2.6833E+01	1.0674E+00	1.4892E-06	8.3730E+02	8.2680E-01	3.8650E+00	7.7049E-02
39	7600000.	7.1905E+02	1.3858E+01	8.2229E-01	2.7579E-07	8.1745E+02	2.7586E-01	1.6171E+00	4.0197E-02
40	7800000.	8.0825E+02	7.0877E+00	6.5829E-01	4.3110E-08	7.1590E+02	7.5712E-02	6.1021E-01	2.2694E-02
41	8000000.	7.2481E+02	3.8099E+00	5.2203E-01	5.0820E-09	5.9712E+02	1.8096E-02	1.3459E-01	1.3686E-02

K	ALT	H2O2 + O4	HO2 + O4	HOCL + OH	CH4 + OH	O4 + NO2	OH + HNO3	OH + OH	H + HO2	CL + HO2
1	0.	7.7697E+05	1.0372E+05	4.7938E+04	8.4210E+05	2.0851E+04	1.4950E+04	2.4847E+01	6.2262E-03	2.8880E+02
2	20000.	5.4718E+05	1.1133E+05	2.5832E+04	6.1673E+05	1.2277E+04	7.4209E+03	3.2081E+01	5.9768E-03	2.2152E+02
3	40000.	2.0978E+05	9.5335E+04	1.1226E+04	3.4728E+05	5.0736E+03	2.8804E+03	2.7562E+01	4.7268E-03	1.2299E+02
4	60000.	6.3784E+04	5.1578E+04	4.0314E+03	1.2.82E+05	2.0580E+03	9.429.E+03	1.8057E+01	2.9782E-03	5.0832E+01
5	80000.	1.8893E+04	2.2581E+04	1.0760E+03	6.2630E+04	1.1576E+03	3.1785E+02	7.2368E+00	1.2036E-03	2.3318E+01
6	100000.	5.1521E+03	9.3152E+03	4.1375E+02	2.3612E+04	6.5163E+02	1.0577E+02	2.7133E+00	4.7322E-04	8.4395E+00
7	120000.	1.1090E+03	3.5301E+03	1.4221E+02	8.6742E+03	3.0746E+02	6.1894E+01	1.1181E+00	1.9366E-04	5.8569E+00
8	140000.	1.2368E+02	1.3140E+03	1.5807E+02	1.0149E+03	6.0831E+02	2.6402E+01	3.1036E-01	4.7557E-05	2.5369E+00
9	160000.	1.7937E+02	1.1963E+03	2.2290E+02	1.2775E+03	1.3820E+03	7.4744E+01	6.0514E-01	4.8465E-05	5.3037E+00
10	180000.	3.6798E+02	2.1875E+03	4.3600E+02	1.0456E+03	3.6254E+03	3.2648E+02	1.6227E+00	1.9868E-04	1.9209E+01
11	200000.	9.5207E+02	3.4279E+03	9.0634E+02	1.5828E+03	4.8482E+03	5.4321E+02	2.7780E+00	1.9459E-04	3.4853E+01
12	220000.	1.1146E+03	4.3788E+03	6.7048E+02	1.5146E+03	5.9147E+03	7.2500E+02	4.4842E+00	3.7708E-04	5.3878E+01
13	240000.	1.8233E+03	7.2.05E+03	6.3187E+02	1.4502E+03	7.8182E+03	8.5949E+02	7.9026E+00	6.1920E-04	8.0308E+01
14	260000.	2.7466E+03	8.0833E+03	6.5704E+02	1.4715E+03	1.0.63E+04	9.4083E+02	1.4850E+01	1.9692E-03	1.1511E+02
15	280000.	3.5531E+03	8.4385E+04	7.2789E+02	1.4968E+03	1.4471E+04	9.0770E+02	3.0492E+01	5.1031E-03	1.7101E+02
16	300000.	3.7836E+03	6.7481E+02	1.6317E+03	1.6173E+04	8.0981E+02	6.6365E+01	1.3938E-02	2.6288E+02	
17	320000.	3.7016E+03	2.6417E+04	1.0221E+03	1.6571E+03	1.5529E+04	7.0561E+02	1.4853E+02	4.0257E-02	3.9452E+02
18	340000.	2.7116E+03	1.3476E+03	1.3476E+03	1.3936E+03	1.2714E+04	5.8465E+02	3.2271E+02	1.5346E-01	5.5093E+02
19	360000.	1.3903E+03	8.1931E+04	1.5395E+03	1.4597E+03	8.8952E+03	4.3869E+02	6.4774E+02	3.1716E-01	6.8574E+02
20	380000.	8.2262E+02	3.8775E+04	1.6302E+03	1.2367E+03	5.0937E+03	2.8190E+02	1.1626E+03	8.5184E-01	7.8462E+02
21	400000.	4.3608E+02	2.0.78E+04	1.6023E+03	1.0314E+03	2.3801E+03	1.3692E+02	1.6834E+03	2.1799E+00	8.4347E+02
22	420000.	2.1761E+02	2.3736E+04	1.4410E+03	7.3431E+02	1.1388E+03	6.7560E+01	1.8865E+03	5.1206E+00	8.3835E+02
23	440000.	2.1351E+02	2.2.7E+04	1.1374E+03	4.9336E+02	2.5928E+02	2.7264E+01	1.7529E+03	1.0679E+01	7.5839E+02
24	460000.	1.0115E+02	1.5923E+04	9.6252E+02	3.2739E+02	7.1527E+01	3.2246E+00	1.4348E+03	1.9272E+01	6.1988E+02
25	480000.	8.9559E+01	1.2.75E+04	8.7009E+02	2.0775E+02	1.9621E+01	7.9148E-01	1.0977E+03	3.0323E+01	4.7081E+02
26	500000.	5.5916E+01	8.7474E+03	4.7303E+02	1.2954E+02	5.7475E+00	1.8886E-01	8.3595E+02	4.3177E+01	3.4926E+02
27	520000.	3.5135E+01	5.8314E+03	3.2871E+02	8.0468E+01	1.6049E+00	4.0563E-02	6.2051E+02	5.7432E+01	2.5017E+02
28	540000.	1.3961E+01	4.7314E+03	2.2.6E+02	4.3667E+01	4.2863E-01	1.2467E-02	4.7315E+02	7.3889E+01	1.8068E+02
29	560000.	1.2821E+01	7.7525E+03	2.2624E+02	3.0234+7E+01	1.6546E-01	3.1960E-03	3.7516E+02	9.0845E+01	1.3175E+02
30	580000.	7.7576E+00	2.92..E+03	1.4577E+02	1.8484E+01	4.9929E-02	8.0341E-04	2.8542E+02	1.2196E+02	9.2893E+01
31	600000.	4.6134E+00	2.1152E+03	7.1118E+01	1.1.19E+01	1.4051E-02	1.9810E-04	2.1679E+02	1.5096E+02	6.5031E+01
32	620000.	2.2112E+00	1.4727E+03	3.3394E+01	5.2248E+00	3.3425E-03	4.4745E-05	1.4993E+02	1.6751E+02	4.3171E+01
33	640000.	8.1493E-01	8.2111E+02	2.5135E+01	2.8912E+00	1.0584E-03	8.3547E-06	8.9429E+01	1.6634E+02	2.6430E+01
34	660000.	2.7775E-01	8.5.63E+02	1.3807E+01	1.8012E+00	3.7437E-04	1.4669E-06	5.1598E+01	2.4524E+02	2.1054E+01
35	680000.	3.3123E-11	5.2341E+02	1.2650E+01	9.4490E-01	1.0258E-04	5.2893E-07	5.8413E+01	2.9081E+02	1.4244E+01
36	700000.	1.3673E-11	4.6453E+02	6.0204E+00	4.3282E-01	2.5950E-05	1.0525E-07	3.1925E+01	3.6110E+02	9.5673E+00
37	720000.	1.0629E-11	7.5183E+02	2.2.80E+00	2.4514E-01	6.4413E-06	2.0865E-08	4.1000E+01	4.6750E+02	6.5343E+00
38	740000.	5.2775E-12	2.6356E+02	3.2.78E+00	1.2107E-01	1.4230E-06	3.8486E-09	3.1975E+01	6.0206E+02	4.4253E+00
39	760000.	1.4679E-12	1.3287E+02	1.3608E+00	4.3500E-02	2.7626E-07	4.6767E-10	1.7730E+01	5.7888E+02	2.6620E+00
40	780000.	2.8274E-13	5.3153E+01	7.7151E-01	1.7146E-02	4.3154E-08	4.3786E-11	6.1652E+00	4.8364E+02	1.8568E+00
41	800000.	7.8930E-14	2.3934E+01	2.2.65E-01	5.5320E-03	5.8854E-09	3.3603E-12	3.4124E+00	3.0596E+02	9.2356E-01

MIXING RATIOS:

ALT	H2O	N2O	CH4	FC11	FC12	CH3C	CLX	CCL4	H2
0.	2.3000E-07	1.8637E-13	1.5094E-06	7.5188E-11	2.5485E-10	1.5010E-09	1.0477E-09	1.3000E-10	5.0000E-07
200000.	2.4371E-07	1.8328E-13	1.4835E-06	7.5137E-11	1.5479E-10	1.0934E-09	5.9788E-10	1.2991E-10	4.9481E-07
400000.	2.4931E-07	5.3402E-11	1.4731E-06	7.5075E-11	1.5471E-10	2.3538E-09	3.7106E-10	1.2973E-10	4.9168E-07
600000.	2.4958E-07	7.8219E-10	1.4670E-06	7.4999E-11	1.5460E-10	1.2940E-09	2.4416E-10	1.2965E-10	4.8992E-07
800000.	2.4952E-07	2.5637E-10	1.4637E-06	7.4904E-11	1.5447E-10	1.2731E-09	1.8313E-10	1.2947E-10	4.8902E-07
1000000.	2.4917E-07	2.2351E-11	1.4597E-06	7.4676E-11	1.5416E-10	1.2526E-09	1.4656E-10	1.2905E-10	4.8801E-07
1200000.	2.4329E-07	3.3114E-11	1.4637E-06	7.4187E-11	1.5359E-10	1.2241E-09	1.2461E-10	1.2813E-10	4.8648E-07
1400000.	2.4778E-07	4.6398E-10	1.4473E-06	7.3594E-11	1.5268E-10	1.2113E-09	1.0805E-10	1.2702E-10	4.8488E-07
1600000.	2.4169E-07	1.1011E-09	1.4151E-06	7.0620E-11	1.4826E-10	1.1361E-09	9.0431E-10	1.2088E-10	4.7650E-07
1800000.	2.2239E-07	7.8388E-09	1.3071E-06	5.9605E-11	1.3203E-10	9.1675E-10	6.7069E-10	9.9626E-11	4.4820E-07
2000000.	2.0163E-07	6.2753E-08	1.1967E-06	4.6520E-11	1.1590E-10	7.2442E-10	4.9182E-10	7.6189E-11	4.1772E-07
2200000.	1.7593E-07	8.8752E-08	1.0748E-06	3.7488E-11	9.7488E-11	5.6007E-10	3.2299E-10	5.2079E-11	3.8564E-07
2400000.	1.5137E-07	1.1269E-07	9.5417E-07	2.1133E-11	7.8067E-11	4.2137E-10	1.4690E-10	2.9996E-11	3.5211E-07
2600000.	1.2459E-07	1.3744E-07	8.2224E-07	1.0911E-11	5.8668E-11	2.0578E-10	1.7668E-09	1.3533E-11	3.1751E-07
2800000.	9.3015E-08	1.5075E-07	7.3996E-07	4.4004E-12	4.0536E-11	2.1135E-10	1.8752E-09	4.3884E-12	2.8210E-07
3000000.	7.5616E-08	1.7004E-07	5.9201E-07	2.3572E-12	2.5823E-11	1.3858E-10	1.9033E-09	9.7791E-13	2.4729E-07
3200000.	5.3284E-08	1.8135E-07	4.8647E-07	3.3159E-13	1.5388E-11	8.6213E-11	2.0714E-09	1.5231E-13	2.1435E-07
3400000.	3.7572E-08	1.8955E-07	3.8428E-07	6.7933E-14	8.7374E-12	5.0625E-11	2.1212E-09	1.7467E-14	1.8434E-07
3600000.	2.6396E-08	2.3712E-07	3.0169E-07	1.2710E-14	4.8064E-12	2.8486E-11	2.1513E-09	1.6516E-15	1.5854E-07
3800000.	1.8433E-08	2.3688E-07	2.3948E-07	2.3351E-15	2.7429E-12	1.5567E-11	2.1685E-09	1.4302E-16	1.3767E-07
4000000.	1.3214E-08	1.9905E-07	1.8903E-07	4.4078E-16	1.5753E-12	8.4536E-12	2.1779E-09	1.2661E-17	1.2254E-07
4200000.	9.6644E-09	1.3412E-07	1.4193E-07	9.3706E-17	9.3612E-13	4.7725E-12	2.1829E-09	1.2303E-18	1.1337E-07
4400000.	7.2745E-09	1.3628E-07	1.1534E-07	2.1927E-17	5.6090E-13	2.8633E-12	2.1855E-09	1.3862E-19	1.0998E-07
4600000.	5.5472E-09	1.7071E-08	9.0067E-08	5.8149E-18	3.7704E-13	1.8619E-12	2.1869E-09	1.8534E-20	1.1171E-07
4800000.	4.5911E-09	1.6953E-08	8.6338E-08	1.7217E-18	2.5383E-13	1.3001E-12	2.1877E-09	2.9042E-21	1.1786E-07
5000000.	3.6332E-09	1.6902E-08	7.8937E-08	5.7046E-19	1.7738E-13	9.7690E-13	2.1882E-09	5.3659E-22	1.2751E-07
5200000.	3.1055E-09	1.5026E-08	7.4344E-08	2.1495E-19	1.2835E-13	7.8272E-13	2.1885E-09	1.1674E-22	1.3974E-07
5400000.	2.5745E-09	1.4038E-08	7.1478E-08	8.5496E-20	9.5512E-14	6.5925E-13	2.1887E-09	2.9210E-23	1.5387E-07
5600000.	2.3514E-09	1.3224E-08	6.9623E-08	3.7781E-20	7.2984E-14	5.7744E-13	2.1888E-09	8.3520E-24	1.6927E-07
5800000.	2.1046E-09	1.2624E-08	6.8430E-08	1.8012E-20	5.7088E-14	5.2111E-13	2.1889E-09	2.6931E-24	1.8552E-07
6000000.	1.9116E-09	1.0436E-08	6.7744E-08	9.1259E-21	4.5525E-14	4.8081E-13	2.1890E-09	9.5843E-25	2.0242E-07
6200000.	1.7646E-09	9.1047E-09	6.7371E-08	4.9571E-21	3.7326E-14	4.5218E-13	2.1890E-09	3.7954E-25	2.1906E-07
6400000.	1.6525E-09	9.0116E-09	6.7118E-08	2.9142E-21	3.1474E-14	4.3144E-13	2.1890E-09	1.6844E-25	2.3509E-07
6600000.	1.5528E-09	8.0059E-09	6.6950E-08	1.7911E-21	2.7009E-14	4.1512E-13	2.1891E-09	8.0834E-26	2.5112E-07
6800000.	1.4913E-09	7.9211E-09	6.6857E-08	1.1655E-21	2.3878E-14	4.0244E-13	2.1891E-09	4.1960E-26	2.6652E-07
7000000.	1.4347E-09	6.6073E-09	6.6791E-08	8.0319E-22	2.1443E-14	3.9259E-13	2.1891E-09	2.3675E-26	2.8078E-07
7200000.	1.3888E-09	5.1210E-09	6.6746E-08	5.8413E-22	1.9639E-14	3.8473E-13	2.1891E-09	1.4288E-26	2.9366E-07
7400000.	1.3517E-09	4.2247E-09	6.6718E-08	4.7806E-22	1.8285E-14	3.7851E-13	2.1891E-09	9.1759E-27	3.0428E-07
7600000.	1.3219E-09	3.1948E-09	6.6698E-08	3.4421E-22	1.7267E-14	3.7362E-13	2.1891E-09	6.2133E-27	3.1165E-07
7800000.	1.2979E-09	2.6336E-09	6.6689E-08	2.7904E-22	1.6492E-14	3.6977E-13	2.1891E-09	4.3524E-27	3.1550E-07
8000000.	1.2770E-09	1.3923E-09	6.6634E-08	2.3155E-22	1.5893E-14	3.6676E-13	2.1891E-09	3.0728E-27	3.1617E-07

FN2O = -1.36690E+03 FNOX = -1.34494E+10 FCH4 = -3.43844E+11 FF11 = -8.42315E+05 FF12 = -1.09231E+06

FCH3C = -4.04628E+09 FCLX = -3.46156E+09 FCCL4 = -1.48964E+06 FH2 = -1.09772E+11

K	ALT	HR O3	FO41	FO12	CH3CL	CCL4	CLX
1	0.	2.9368E-08	1.3148E+09	3.4736E+09	3.6165E+10	7.1743E+09	2.4296E+10
2	200000.	2.8041E-08	1.5816E+09	3.2548E+09	2.9458E+10	2.7345E+09	1.2585E+10
3	400000.	2.9588E-08	1.7395E+09	2.9542E+09	2.2021E+10	2.1479E+09	6.1261E+09
4	600000.	3.2505E-08	1.8454E+09	2.6714E+09	1.7346E+10	1.7375E+09	3.2718E+09
5	800000.	3.7677E-08	1.9495E+09	1.6806E+09	1.3851E+10	1.4086E+09	1.3924E+09
6	1000000.	5.1734E-08	6.5215E+08	1.3463E+09	1.0939E+10	1.1278E+09	1.2709E+09
7	1200000.	8.2142E-08	5.2285E+08	1.0611E+09	8.4971E+09	8.8778E+08	1.2071E+09
8	1400000.	1.4337E-07	4.1656E+08	9.0557E+08	7.1843E+09	7.5338E+08	1.1746E+09
9	1600000.	3.3198E-07	3.3852E+08	6.1881E+08	4.6611E+09	4.9593E+08	1.2466E+09
10	1800000.	1.0784E-06	1.9361E+08	3.7548E+08	2.5886E+09	2.8134E+08	1.7811E+09
11	2000000.	2.8244E-06	9.3146E+07	2.3479E+08	1.4480E+09	1.5238E+08	1.0836E+09
12	2200000.	3.2657E-06	4.1854E+07	1.3931E+08	8.6034E+08	7.4426E+07	1.7575E+09
13	2400000.	4.9352E-06	2.1786E+07	8.0561E+07	4.3406E+08	3.8950E+07	1.5766E+09
14	2600000.	8.5453E-06	8.1637E+06	4.3637E+07	2.2765E+08	1.8475E+07	1.2707E+09
15	2800000.	8.8521E-06	2.7363E+06	2.1983E+07	1.1461E+08	2.3798E+06	1.6169E+09
16	3000000.	8.8735E-06	5.7880E+05	1.0254E+07	5.3016E+07	3.8623E+05	7.9134E+08
17	3200000.	8.8736E-06	9.3357E+04	4.4971E+06	2.5179E+07	4.4535E+04	6.0568E+08
18	3400000.	8.8927E-06	1.4654E+04	1.8806E+06	1.0930E+07	3.7725E+03	4.5707E+08
19	3600000.	8.9327E-06	2.1389E+03	7.8378E+05	4.0891E+06	2.6492E+02	3.4506E+08
20	3800000.	5.5647E-06	2.7874E+02	3.2459E+05	1.8601E+06	1.7134E+01	2.5979E+08
21	4000000.	4.2920E-06	4.0886E+01	1.4182E+05	7.6464E+05	1.1534E+00	1.9599E+08
22	4200000.	3.4015E-06	5.9750E+00	6.3677E+04	3.2444E+05	8.7634E-02	1.4839E+08
23	4400000.	2.7078E-06	1.1717E+00	2.9980E+04	1.4808E+05	7.1542E-03	1.1280E+08
24	4600000.	2.2094E-06	2.2861E-01	1.4052E+04	7.3759E+04	7.3005E-04	8.6144E+07
25	4800000.	1.8182E-06	5.7636E-02	7.7139E+03	3.9457E+04	8.8142E-05	6.6398E+07
26	5000000.	1.6376E-06	1.3581E-02	4.2075E+03	2.3172E+04	1.2728E-05	5.1905E+07
27	5200000.	1.4936E-06	3.3236E-03	2.7872E+03	1.4559E+04	2.1713E-06	4.0706E+07
28	5400000.	1.3661E-06	1.2676E-03	1.4056E+03	9.6976E+03	4.2868E-07	3.2196E+07
29	5600000.	1.0471E-06	4.3782E-04	8.4589E+02	6.6935E+03	9.6800E-08	2.5368E+07
30	5800000.	8.9629E-07	1.3462E-04	5.1978E+02	4.7447E+03	2.4521E-08	1.9830E+07
31	6000000.	7.7065E-07	6.3295E-05	3.2542E+02	3.4349E+03	6.8479E-09	1.5638E+07
32	6200000.	7.1809E-07	2.7988E-05	2.1437E+02	2.5485E+03	2.1381E-09	1.2337E+07
33	6400000.	7.0914E-07	1.2866E-05	1.3899E+02	1.9251E+03	7.4385E-10	9.6668E+06
34	6600000.	7.2913E-07	6.1588E-06	9.3764E+01	1.4259E+03	2.7256E-10	7.5194E+06
35	6800000.	4.0586E-07	3.1007E-06	6.3458E+01	1.0713E+03	1.0470E-10	5.8273E+06
36	7000000.	4.3703E-07	1.5275E-06	4.3443E+01	7.9538E+02	4.7906E-11	4.4351E+06
37	7200000.	7.9872E-07	5.8056E-07	3.0146E+01	5.9057E+02	2.1932E-11	3.3603E+06
38	7400000.	3.6915E-07	5.1444E-07	2.1004E+01	4.3695E+02	1.0571E-11	2.5219E+06
39	7600000.	3.8642E-07	2.9444E-07	1.4778E+01	3.1968E+02	5.3149E-12	1.8726E+06
40	7800000.	3.7875E-07	1.7525E-07	1.0250E+01	2.3225E+02	2.7337E-12	1.3750E+06
41	8000000.	4.6094E-07	1.0560E-07	7.2475E+00	1.6710E+02	1.4000E-12	9.9736E+05

K	ALT	N2O	NOX	CH4
1	0.	3.0[illegible]E+12	[illegible]E+10	3.6165E+13
2	200000.	5.26[illegible]E+12	2.1740E+09	3.1267E+13
3	400000.	4.1243E+12	3.7881E+09	2.4321E+13
4	600000.	3.3457E+12	1.3526E+09	1.9658E+13
5	800000.	2.7147E+12	5.8946E+08	1.5925E+13
6	1000000.	2.1756E+12	1.3528E+09	1.2748E+13
7	1200000.	1.7106E+12	2.2885E+09	1.0049E+13
8	1400000.	1.4665E+12	2.7273E+09	8.5349E+12
9	1600000.	3.9165E+11	4.7679E+09	5.8063E+12
10	1800000.	6.2773E+11	8.3426E+09	3.6902E+12
11	2000000.	4.0123E+11	1.2151E+10	2.3850E+12
12	2200000.	2.5283E+11	1.2338E+10	1.5156E+12
13	2400000.	1.5821E+11	1.1633E+10	9.8470E+11
14	2600000.	9.2832E+10	1.0234E+10	6.1961E+11
15	2800000.	5.3149E+10	8.5673E+09	3.9501E+11
16	3000000.	2.922[illegible]E+10	7.1683E+09	2.3503E+11
17	3200000.	1.5574E+10	5.8998E+09	1.4107E+11
18	3400000.	8.1185E+09	4.8485E+09	8.2906E+10
19	3600000.	4.2137E+09	3.9580E+09	4.8234E+10
20	3800000.	2.2135E+09	3.2765E+09	2.7854E+10
21	4000000.	1.1992E+09	1.7986E+09	1.6206E+10
22	4200000.	6.5372E+08	1.3196E+09	9.6501E+09
23	4400000.	3.7544E+08	1.0[illegible]E+09	5.9[illegible]E+09
24	4600000.	6.2243E+08	7.[illegible]E+08	3.8[illegible]E+09
25	4800000.	1.3621E+08	5.1[illegible]E+08	2.6226E+09
26	5000000.	8.7[illegible]E+07	3.7956E+08	1.8736E+09
27	5200000.	5.7767E+07	2.7948E+08	1.3826E+09
28	5400000.	3.9738E+07	2.0543E+08	1.0[illegible]E+09
29	5600000.	2.7756E+07	1.5[illegible]6E+08	8.0695E+08
30	5800000.	1.9167E+07	1.1[illegible]8E+08	6.[illegible]36E+08
31	6000000.	1.3[illegible]E+07	7.9550E+07	4.8472E+08
32	6200000.	3.9457E+06	5.3[illegible]E+07	3.[illegible]7E+08
33	6400000.	7.2976E+06	3.9[illegible]E+07	2.9639E+08
34	6600000.	6.3681E+06	[illegible]E+07	2.300[illegible]E+08
35	6800000.	3.3639E+06	1.6[illegible]E+07	1.7797E+08
36	7000000.	6.9058E+06	1.2[illegible]E+07	1.3536E+08
37	7200000.	2.1313E+06	7.8817E+06	1.0245E+08
38	7400000.	1.5[illegible]E+06	[illegible]E+06	7.6857E+07
39	7600000.	1.1307E+06	2.9[illegible]E+06	5.7045E+07
40	7800000.	8.152[illegible]E+05	1.5561E+06	[illegible]E+07
41	8000000.	5.8271E+05	8.[illegible]E+05	3.0368E+07

NORMAL JOB END.